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PUBLIC NOTICES.

HEATING.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Tuesday, 27th September, 1932, for (1) ACCELERATED LOW-PRESSURE HOT WATER HEATING, &c., at the Chemical Research Laboratory, Teddington, Middlesex; and (2) SUPPLY and ERECTION of a VERTICAL STEAM BOILER at H.M. Stationery Office, Harrow, Middlesex.

Drawings, specification, a copy of the conditions and form of contract, bills of quantities, and forms for Tender may be obtained from the CONTRACTS BRANCH, H.M. Office of Works, King Charles-street, London, S.W.1, on payment of One Pound in each case. (Cheques payable to the Commissioners, H.M. Office of Works.) The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 8933

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Director of Education.

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The SESSION COMMENCES on THURSDAY, OCTOBER 6th. 8868

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The Engineer

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Full particulars of courses and of the University Halls of Residence may be obtained on application to the REGISTRAR, M.V.T. College, Bristol.

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London County Council.

TENDERS are INVITED for the CLEANING, REPAINTING, &c., of CHALK FARM-ROAD BRIDGE and MITRE BRIDGE.

Specification, form of Tender, &c., may be obtained on application to the Chief Engineer upon payment of £1 by crossed cheque, or order payable to the London County Council. (NOTE.—CASH WILL NOT BE ACCEPTED.) This amount will be returnable only if a BONA FIDE Tender has been sent in and not subsequently withdrawn. Full particulars of the work may be obtained on personal application, and the contract documents may be inspected before payment of the fee.

Remittances by post should be addressed to the Chief Engineer (A), The Old County Hall, Spring-gardens, S.W.1. Personal inquiries at Room 2, No. 3, Warwick House-street, Cockspur-street, S.W.1.

The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in THE LONDON COUNTY COUNCIL GAZETTE.

No Tender received by the CLERK OF THE COUNCIL, at The County Hall, Westminster Bridge, S.E.1, after 4 p.m. on Monday, 26th September, 1932, will be considered.

The Council does not bind itself to accept the LOWEST or any Tender. 8934

PUBLIC NOTICES.

Metropolitan Borough of STEPNEY.
ELECTRICITY SUPPLY.

NOTICE IS HEREBY GIVEN that the Council of the Metropolitan Borough of Stepney will receive TENDERS from such persons as may be willing to enter into a contract for the SUPPLY, DELIVERY and ERECTION of ONE HAND-DRIVEN TRAVELLING CRANE at the Council's Generating Station at Limehouse.

Contractors will be required at all times during the existence of their contracts to pay the TRADE UNION rates of wages, and observe the Trade Union conditions as agreed to by the Employers' Associations and Trade Unions, and as in practice obtain, in connection with all works executed by the contractors, whether carried out for the Council or others.

Contractors will also be prohibited from assigning or underletting their contracts without the written consent of the Council previously obtained.

The contractor shall on those sections of the Works which do not call for and/or require the employment of skilled or semi-skilled labour employ not less than 75 per cent. of workmen resident in the Metropolitan Borough of Stepney. Any authorised sub-letting shall likewise be subject to a like provision at the instance of the contractor. The contractor and any sub-contractor will be required to submit satisfactory evidence of compliance with the foregoing stipulation. The operation of this clause is expressly limited to the work of erection of the plant at the Limehouse Generating Station.

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Sealed Tenders must be addressed to the Chairman of the Electricity Supply Committee, endorsed "Tender for Crane," and left at No. 27, Osborn-street, E.1, before Noon on September 26th, 1932.

The Council do not bind themselves to accept the lowest or any Tender.

W. L. McCARTY,
Town Clerk.

Municipal Offices,
Raine-street, E.1. 8942

PUBLIC NOTICES.

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A fee of 10s. will be charged for each copy of the specification, which is NOT returnable.

Tenders must be submitted not later than NOON on Friday, 30th September, 1932.

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By Order of the Board,
E. GRANT,
8930 Secretary.

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The Engineer

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A Seven-Day Journal

The Wigan Railway Centenary.

A RAILWAY centenary of historic importance occured on September 3rd, which was the hundredth anniversary of the opening in 1832 of the Wigan Branch Railway from Parkside, a junction on the former Liverpool and Manchester Railway, to Wigan. Originally promoted to connect with the Liverpool and Manchester Railway, which was opened in September, 1830, the Wigan Branch Railway obtained its Act of incorporation in May, 1830, and ran from Wallgate-street, Wigan, *viâ* Chapel-lane, Dobbs Bridge, Bamfurlong, and Golborne to a junction with the Liverpool and Manchester Railway near Parkside-lane Bridge, about 1¼ miles east of Newton, where there were junctions with the Liverpool and Manchester Railway towards Liverpool on one side and towards Manchester on the other. The cost of the single line with passing places was estimated at £70,000, and the engineer was the famous Charles Vignoles. In 1834 the railway became part of the North Union Railway, sanctioned in 1831, which extended the track for another 15¼ miles from Wigan to Preston. At Newton the line from Wigan joined the Warrington and Newton line, opened in 1833, and when the through route to the North was established, and for many years afterwards, all through traffic between North and South had to pass over the very congested junctions at Newton, where the line between Preston, Wigan, and Warrington met that between Liverpool and Manchester. To obviate this congestion and to give a through route for North and South trains a direct line was opened in 1872. It leaves the Warrington-Newton line south of Newton and rejoins the original Wigan Branch Railway at Golborne, north of Newton, thus forming an important link in the through route to the North.

The Barking-Upminster Electrification.

ON Thursday last "dress rehearsal" trials of the newly widened and electrified L.M.S. Railway between Barking and Upminster were carried out. The new length of electrified line will enable passengers from Upminster and intermediate stations to obtain direct access to the City and West End by the District Railway without change. It will also afford relief on the existing steam lines from local traffic and will thus increase the capacity of fast steam trains between Southend, Fenchurch-street, and Broad-street. In non "rush hours" a twenty-minute service of electric trains, with seating accommodation for 200 passengers, will be maintained, but during the morning and evening "rush hours" the service will be considerably strengthened. From Barking the stations on the new line are Upney, Becontree, Heathway, Dagenham, Hornchurch and Upminster. Of these Upney and Heathway, served by the electric line only, are entirely new; Becontree, a four-platformed station serving the London County Council Becontree estate, replaces Gale-street Halt; while Dagenham, Hornchurch, and Upminster have been remodelled and modernised. The platforms are all 700ft. in length, 300ft. of which is covered. The power supply for the system is obtained from the London Electric Supply Company's sub-station at Heathway at 11,000 volts, and is converted to 600 volts at four L.M.S. sub-stations situated at Heathway, Upney, Hornchurch, and Upminster. Heathway will be the key sub-station of the line, and will be the only one attended. The other sub-stations will be controlled automatically from it. Three-aspect multiple-colour light signals will ensure that the track can be used to its fullest possible capacity under anything but the most abnormal weather conditions. Altogether thirty-seven signals will guard the 7¾ miles of track.

A Naval Launch and a Completion.

ON Thursday of last week, September 1st, there was launched from the Birkenhead yard of Cammell Laird and Co., Ltd., the new "Leander" class cruiser H.M.S. "Achilles," belonging to the 1930 programme. The naming ceremony was performed by Lady Stanley, wife of Lord Stanley, Parliamentary and Financial Secretary to the Admiralty. The keel of the "Achilles" was, it may be recalled, laid in June last year by Prince George. She has a length of 520ft., with a beam of 52ft. 2in., and at the mean draught of 16ft. her standard displacement will be about 7000 tons. The propelling machinery, which has been constructed and will be installed by the builders, consists of single reduction geared turbines taking high-temperature steam from high-pressure water-tube boilers. The shaft horse-power to be developed by the turbines will be about 72,000, which, it is estimated, will give the cruiser a speed of 32¼ knots. The main armament comprises eight 6in. guns, mounted on four turrets, and the vessel will also carry four 4in. anti-aircraft guns and four 3-pounders, with six 21in. torpedo tubes in triple mounts. On Monday last, September 5th, H.M.S. "Daring," the first torpdeo-boat destroyer to be completed of those ordered under the 1930 Naval Estimates, left Thornycroft's Southampton shipyard and proceeded to Plymouth for her acceptance trials. The vessel is one of the "Defender" class of destroyers of Admiralty design, having a length of 315ft. and a displacement of approximately 1390 tons. Her engines are designed to develop approximately 36,000 S.H.P., to give an estimated speed of 36 knots. It is interesting to record that this is the third "Daring" to be built by Thornycrofts for the Navy.

World Telegraphy and Radio Telegraphy.

THE Joint International Conference on Telegraphy and Radiotelegraphy, which was opened on Saturday morning last, September 4th, in Madrid, by the Spanish Prime Minister, Don Manuel Azaña, will extend over two months and will deal with world problems of telegraphic and radio-telegraphic communication. About five hundred and thirty delegates, representing some one hundred and twenty-five states, are attending the Conference, and some 3000 propositions are to be dealt with. The United Kingdom is represented by a group of sixteen delegates and experts under the leadership of Mr. F. W. Phillips, Assistant Secretary to the Post Office; while Admiral Sir Charles Carpendale, assisted by observers, will represent the British Broadcasting Corporation. Marine representatives include Mr. W. A. Souter, the Chairman of the Wireless Committee of the Chamber of Shipping and the International Shipping Conference, with other shipowners, and Mr. F. S. Hayburn, deputy managing director of the Marconi International Marine Communication Company, Ltd., with other officials of the company. In this connection it is of interest to record that a symposium on "Wireless and Shipping," describing the progress made to date, has been prepared for the Conference delegates by our contemporary the *Shipping World*. The work of the Conference will cover the commercial, military, and maritime aspects of the problems investigated and will, it is expected, be of great importance with regard to the drawing up of an international convention which may govern later international legislation.

Sale of Electricity.

CONSIDERABLE increases in the sales of electricity are indicated by the returns of the Electricity Commissioners for 1930–31, issued on Wednesday last. In all 666 separate authorised undertakings, including 483 generating stations, are dealt with. The units sold during the year totalled 9073 millions, an increase of 408 millions, or 4·7 per cent., on the preceding year's total. This increase occurred in spite of a reduction of 37 million units sold for power purposes, and represents an increase of the lighting and domestic loads of 17 per cent. On the estimated population of 44,700,000 persons, the consumption works out at 203 units per head. The actual number of consumers connected to the public supply systems dealt with was 4,015,000, an increase of 15 per cent. In spite of the degree of standardisation that has been achieved electricity is still supplied at forty-five different voltages.

Safety in Mines.

IN the annual report of Mr. Frazer, H.M. Divisional Inspector of Mines for Yorkshire, comments are made upon a reduction of 16½ per cent. in the number of deaths from falls of roof. Mr. Frazer suggests that the use of steel pit-props is one of the causes of the reduction. The length of roadways supported by steel arches increased from 73 miles in 1930, to 126½ miles in 1931. From the answers to a questionnaire sent out by Mr. Frazer, he found that steel props were in use at the faces of twenty-nine mines, and that during the year the number employed had increased from 20,500 to 95,500. Twelve collieries adopted steel arches for the first time during the year. Some of the mine managers declared that in no circumstances would they revert to the use of wooden props. Dealing with the lighting of mines, Mr. Frazer reports an improvement. The number of electric cap lamps in use was nearly doubled, although these lamps still formed a very small proportion of the total in use. Cap lamps allow the men to have both hands free for work and are particularly suitable for haulage employees. Mr. Frazer states that the attitude of a few managers in opposing them on the grounds of the slight extra expense is inexplicable. Attention is also drawn to the fact that whitewash on the brickwork and roof causes an improvement in the lighting effect. Mention is made in the report of a safer means of blasting in mines. The device utilises the increase of volume when liquid carbon dioxide vaporises.

Miss England III.

OWING to engine trouble, Lord Wakefield's speed boat, "Miss England III.," piloted by Mr. Kaye Don, was unable to wrest the Harmsworth Trophy from "Miss America X." in the races held at St. Clair Lake, Detroit, last week-end. The trophy was retained by Commodore Gar Wood, who on Saturday made an average speed of 76·014 miles per hour and on Monday 69·036 miles per hour over the 35-mile course. Mr. Kaye Don was awarded a prize for the fastest lap in Saturday's race, which was his first. He made a speed of 88·685 miles per hour against Mr. Gar Wood's fastest record of 87·387 miles per hour made in his second lap. Towards the end of Saturday's race one of "Miss England's" engines failed and the boat was also partly waterlogged. Examination showed that the starboard engine throttle had broken away, depriving the engine of fuel, while the breakage also caused a water discharge pipe to empty cooling water into the boat. On Monday it appears that the engines of "Miss England III." stopped near the end of the second lap, allowing Commodore Gar Wood to finish the course and win the trophy. The cause of the stoppage is reported to have been the breakage of the throttle control shaft, which, in spite of Mr. Garner's efforts, to hold open the throttle by hand, shut down the starboard engine. The whole of the load then being thrown on the port engine, a piston seized and a liner was damaged. The boat is to return with Mr. Kaye Don to England for examination and repairs.

The "Queen of Bermuda."

ON Thursday of last week, September 1st, the "Queen of Bermuda," the new quadruple-screw turbo-electric liner for the New York–Bermuda service of Furness, Withy and Co., Ltd., was successfully launched at the Naval Construction Works of Vickers-Armstrongs, Ltd., at Barrow-in-Furness. The naming ceremony was performed by Lady Cubitt, the wife of His Excellency Lieut.-General Sir Thomas Astley Cubitt, the Governor of Bermuda. At the luncheon which followed the launch General Sir Herbert A. Lawrence, the chairman of Vickers-Armstrong, Ltd., thanked Lady Cubitt, and General Cubitt replied. Lord Essendon spoke on behalf of the owners, and Commander Craven responded for the builders. The new liner will have accommodation for 731 passengers, and will show an improvement on the "Monarch of Bermuda," which was built at the Walker Shipyard in October last and was described in THE ENGINEER of November 27th and December 4th and 11th, 1931. She has a water line length of 576ft., with a breadth moulded of 76ft. 6in., a depth to C deck of 43ft. 3in., and a measurement of about 22,500 gross tons. Her propelling machinery, which is designed for a trial speed of 19¾ knots, will comprise a quadruple-screw arrangement of two turbo-alternators and four propelling motors, designed and built by the General Electric Company, Ltd., of Witton, and Fraser and Chalmers Engineering Works, of Erith. The total output of the four propelling motors will be 19,000 S.H.P., and there are to be two 10,000 horse-power turbines running at 3000 r.p.m., driving two 7500 kW alternators which will supply current to four 150 r.p.m. propelling motors. Steam will be raised in four high-pressure Babcock and Wilcox water-tube boilers, designed for 400 lb. pressure, with a superheated steam temperature of 650 deg. to 675 deg. Fah. The auxiliary machinery will include Weir regenerative condensers and auxiliary pumps of the latest design.

A Documentation Conference.

THE eleventh conference of the International Institute for Documentation, which was held at Frankfurt-on-Main last week, is of some interest to engineers and manufacturers, as the problems dealt with included not only the collection, filing, and unification of books, periodicals, and newspapers, but also business correspondence, patents, drawings, and other records. Suggestions were made for improving the Dewey system of decimal classification, which in 1927–1929 had been extended from 36,000 subdivisions to 60,000 sub-divisions with an alphabetical index of about 80,000 catchwords, since that date fuller progress has been made by the International Institute at Brussels in adapting the decimal classification to the demands of scientific development. This year the conference considered some new methods of documentation and the application of specialised machines, such as photostatic reproducers, multigraphs, and addressing machines, to the tasks which it has undertaken. Representatives were present from the Science Museum, South Kensington, the German Standards Committee, and similar organisations in France, Belgium, Italy, and Switzerland, and some other countries.

The New Cunarder.

CONSIDERABLE interest was caused, within the last few days, by a remark attributed to Sir Thomas Royden, the late chairman and now a director of the Cunard Company, to the effect that work upon the new liner under construction at John Brown's Clydebank yard might be resumed earlier than expected. The Cunard Company's official statement says that the company has received no intimation from Sir Thomas Royden with regard to the statement attributed to him, but it appreciates very fully the many kindly and helpful suggestions which have appeared from time to time in newspapers and journals. It believes that these statements largely reflect the public interest in the new liner. The company reiterates its need of the ship from every point of view, and the desirability of resuming work upon her at the earliest possible moment, bearing in mind the all-important question of finance attached to the construction of such a vessel. Immediately the company is in a position to make a definite pronouncement the public will be informed of its plans.

Bangkok Bridge.

No. I.

THE Bangkok Memorial Bridge commemorates the founding of the Royal City of Ratana Kosindra (Bangkok), the present capital of Siam. The city was founded on the left bank of the river Chao Phya by King Phra Buddha Yodfa, the first sovereign of the Royal House of Chakri. On the right bank lies Dhonburi, the old capital of Chao Tak Sin. Development on this side of the river has been much hampered for want of direct communication with the new city. It was with the object of promoting the development of the right bank that the authorities decided that the National Memorial should take the form of a road bridge providing direct communication between the two cities.

Representatives from prominent bridge-building firms throughout the world—from America, Denmark, France, Germany, Italy, and Great Britain—were invited to visit Bangkok in 1928, where the scheme for the bridge project was placed before them. They were invited to prepare designs and to furnish estimates for the whole of the work, including the bridge and its approaches. The Siamese specification laid down the general requirements as to the carrying capacity of the bridge, the clear openings and headroom required, and the lay-out of the approaches and architectural treatment. In all other respects, the design was left entirely in the hands of the tenderers. The supervision of the engineering work was entrusted to Messrs. Sandberg, consulting engineers to the Royal State Railways of Siam. In the summer of 1929 the contract for the work was placed with Dorman, Long and Co., Ltd., of Middlesbrough, at a price of £255,141.

The works comprising the contract were subdivided into six main divisions :—

(1) The bridge proper.
(2) East approach viaduct and embankment.
(3) West approach viaduct and embankment.
(4) River wall and stairways.
(5) Pontoon landing stages.
(6) Architectural treatment.

The arrangement of the bridgework is shown upon a Supplement accompanying this issue.

The river crossing, 750ft. wide between faces of abutments, is divided into three main openings. The two side openings of 247ft. each are covered by fixed through-type steel lattice girders. The central opening of 196ft. is spanned by a double-leaf bascule, electrically operated. The river ends of the side spans and the bascule spans are supported upon large piers with caisson foundations, 98ft. below mean water level. The shore ends of the side spans are supported upon abutments founded upon reinforced concrete piles. The east approach consists of a U-shaped reinforced concrete viaduct, upon piled foundations, leading down from the bridge deck. Beyond the end of this viaduct the two approach roads are brought down to ground level upon earth-filled embankments supported by concrete retaining walls. The same construction is adopted for the west approach, but in this case only a single approach road leads on to the bridge. The river frontages upon both sides of the river for a length of 400ft. are protected by reinforced concrete sheet piling, tied back to anchor piles and capped by a concrete coping and balustrade. Stairways are provided at intervals giving access to the water. Four steel landing pontoons, 33ft. by 16ft., are anchored in front of the river wall, guided between piled dolphins and connected to the shore by short steel bridges.

The architectural treatment included the provision of four large reinforced concrete pylons, 60ft. high, immediately behind each of the bridge abutments, flanked by stairways leading from the bridge deck to the ground below. Other flights of steps were provided connecting the deck of the east approach viaduct with the area enclosed between the two arms of the approach. The full architectural proposals outlined in the contractor's offer and prepared for them by Sir J. Burnet and Partners, included the laying out of gardens within this enclosure and the construction of awnings projecting from either side of the approach viaducts below which shops would be constructed. The actual memorial is situated on the axis of the bridge at the apex of the space enclosed between the two arms of the east approach. The architects' proposed lay-out is shown in Fig. 1, and in the photograph reproduced in Fig. 2 the completed bridge can be seen.

The bridge and approaches accommodate a roadway, 33ft. wide between kerbs, with cantilevered footwalks, 8ft. 3in. wide on each side. Provision is made for carrying a double tramway track across the bridge, but this track has not yet been constructed. The bridge also carries a 20in. diameter water main under one footway, special provision being made for "breaking" this pipe line during the operation of the bascule span. The approaches are graded up at 3 per cent. to the bridge abutments with gradients of 2·36 per cent. on the side spans, to give a clear headroom of 24ft. 6in. above mean water level under the steel work of the bascule span. The design was prepared, in accordance with the British Standard Specification, to provide for modern heavy highway traffic. British steel, rolled and fabricated in Middlesbrough, was used throughout the construction of the bridge.

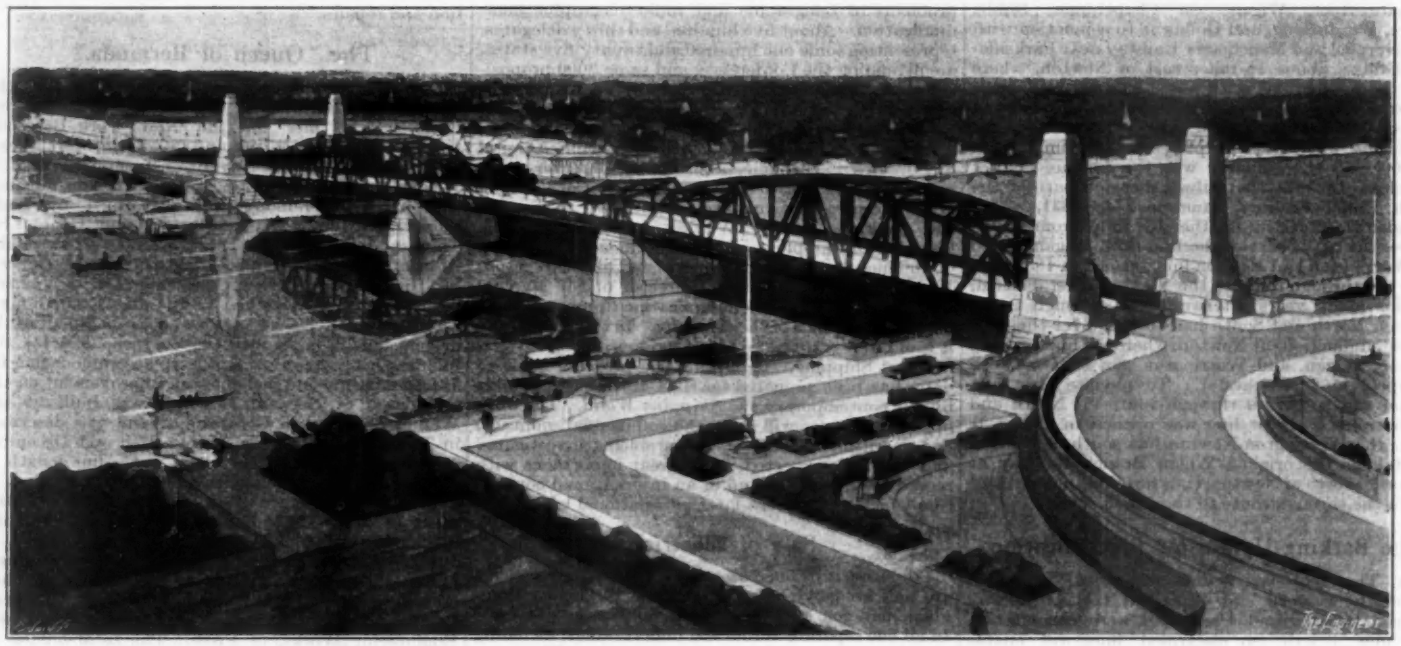


FIG. 1—ARCHITECT'S PROPOSED LAY-OUT OF BRIDGE

THE BRIDGE PROPER.

Side Spans.—The side spans are supported by through-type steel lattice girders with Warren bracing, 247ft. span centre to centre of bearings, divided into ten panels of 24ft. 8in. Drawings are reproduced in the Supplement. The trusses have a maximum depth of 37ft., with curved upper chords. Complete top and bottom lateral bracing is provided throughout with effective sway bracing on intermediate verticals and portals on the end rakers. The roadway deck is of reinforced concrete, 6in. thick, surfaced with 1½in. of asphalt. The roadway slab is carried by eight lines of steel joist stringers framed into plated cross girders. The footway decking is formed of a 3in. reinforced concrete slab surfaced with 1in. of asphalt carried on steel stringers resting upon brackets cantilevered from the ends of the main cross girders. Ornamental wrought iron

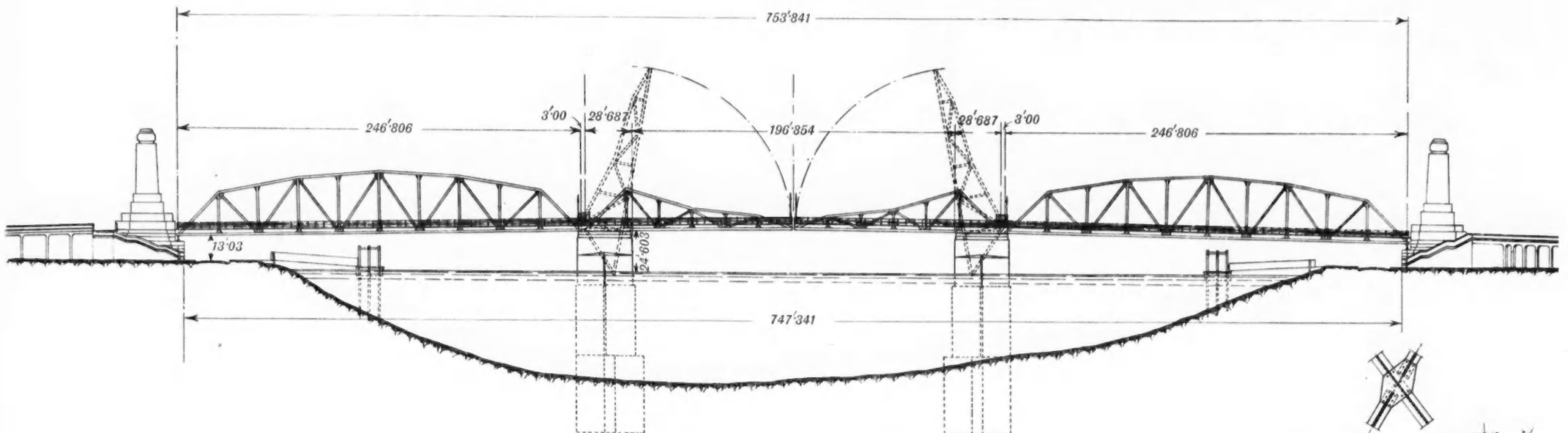
FIG. 2—AERIAL VIEW OF COMPLETED BRIDGE AND APPROACHES

parapets are provided on both footways. Cast steel sliding bearings are included to allow for expansion at the shore ends of the spans, which are fixed at the river end in the main piers.

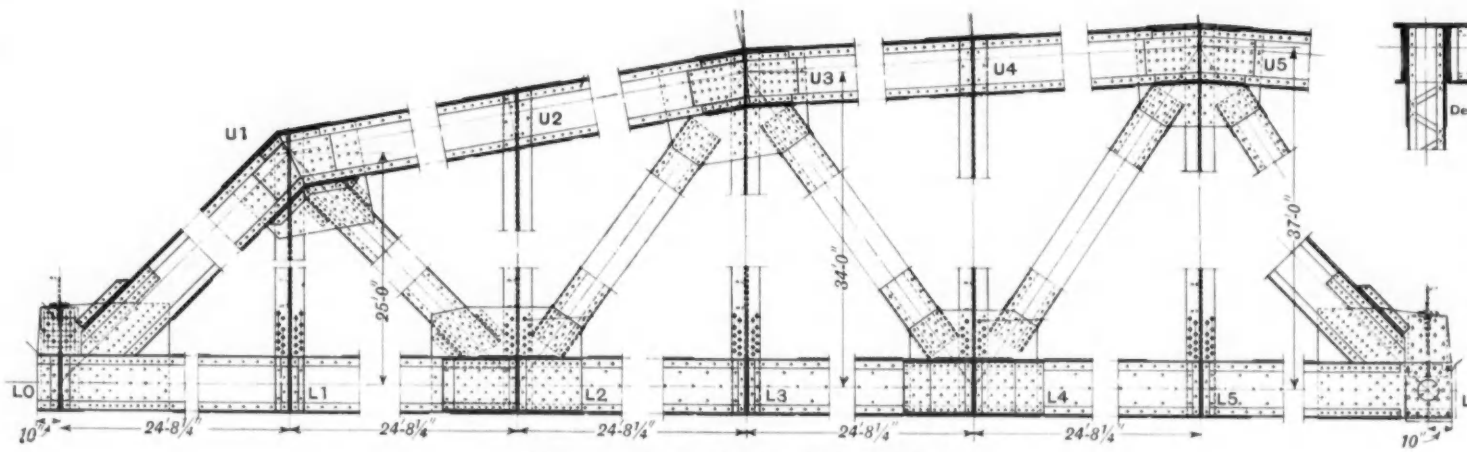
Central Span.—The central opening of 196ft. is covered by a double-leaf bascule span supported by through lattice girders. Details of this span can be seen in the drawings reproduced in the Supplement. The length of each river leaf centre to centre of intersections is 101ft. 6in. and the length of the anchor arm 24ft. 8in. Each river leaf is divided into five panels

THE BANGKOK MEMORIAL BRIDGE

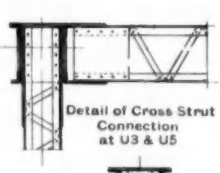
DESIGNED AND CONSTRUCTED BY DORMAN, LONG AND CO., LTD., MIDDLESBROUGH



SIDE ELEVATION OF BRIDGE



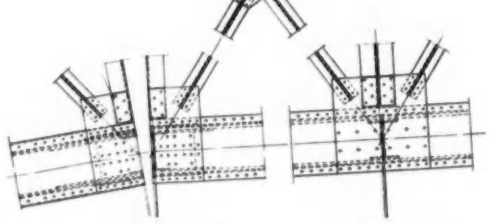
SIDE ELEVATION OF FIXED SPAN



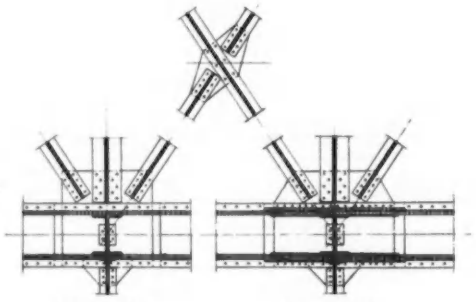
Detail of Cross Strut Connection at U3 & U5

Diaphragm for Chords

Material in Joint L4
2 -¾" Main Gussets
2 Cov. Pls. 22½"x½"x 5'-0⅜"
2 Cov. Pls. 22½"x½"x 5'-0⅜"
2 Cov. Pls. 4"x ⅞"x 2'-9½"
2 Fills 22½"x 7/16"x 2'-6 7/16"



Joint at U3 Joint at U4



Joint at L3 Joint at L4

Section C-C

Fixed Span

Half Elevation of Intermediate Cross Girder

Section D-D

Section E-D

Fixed Span

Half Elevation of End Cross Girder

Section H-H

Section J-J

DECK STEELWORK OF FIXED SPAN

Line thro' ctrs. of Main Trunnion & Side Span Bearing

C.L. of X Girder

End of Main L & Side Pl.

24'-3½" to C.L. Main Trunnion (Horizl. dimension)

C.L. of Counterweight Trunnion

Section F-F

Material at Joint U3
2 Main Gussets ¾ th.
2 Pls: 12"x⅝"x 5'-6" (av.)
4 Pls: 3"x½"x 2'-3" (av.)
2 Pls: 4"x⅝"x 3'-3"
1 Plate 26¼"x⅜"x 3'-9"
4 Fills 3"x½"x 1'-2½" (av.)
2 Fills 12"x⅛"x 3'-0" (av.)

Plan on Top

Diagram showing Dimensions of Intersections for Truss

C.L. of Counterweight Trunnion

C.L. of Side Span

Ctr. of Side Span Bearing

Hole for 1-2" dia. Bearing

C.L. of X Girder & Diaphragm

Hole for 1-3" dia. Bearing

24'-11"925 rad. from Main Trunnion ctr. to Rack Pinion ctr.

25'-10¾" rad. to Rack Pitch

C.L. X Girder

Sectional Plan on B-B

20'-5 to C.L. of X Girder & Diaphragm

24'-3½" (Horizl. Dimension)

Outside Elevation of Truss

Sectional Plan on Bottom Flange of Bottom Chord

SIDE ELEVATION OF BASCULE SPAN

Section on T-T

Bascule Span
Half Elevation of Intermediate Cross Girder

Section RX

Section SX

Bascule Span
Half Elevation of End X Girder

Section showing arrgmt. for expansion between Bascule Spans.

View W-W
Showing Footway Expansion Bracket between Bascule Spans

Details of Ends of Fixed and Bascule Spans

"THE ENGINEER"

DECK STEELWORK OF BASCULE SPAN

of 20ft. 3½in. Complete bottom bracing is provided throughout. The roadway clearance only permits of transverse bracing between the upper chords over the main trunnions. The bascules are of the fixed trunnion type, and are counterweighted by massive cast iron counterweights in steel boxes, suspended by links hinged to the ends of the anchor arms. The counterweights and the whole of the operating machinery are contained in watertight chambers constructed in the river piers and are completely invisible from the river or the bridge deck.

Under dead load the bascule leaves and their counterweights are in perfect balance about the main trunnions for all positions. When the leaves are in the down position, the tails of the bascules are locked by means of bolts to the columns supporting the approach spans, while the noses of the leaves at the centre of the opening are connected by a shear lock, so that under live load each leaf is in the condition of a cantilever with its outer end freely supported upon the adjacent bascule.

The deck of the bascule span is of hardwood timber. On the roadway a longitudinal layer of 3in. timber rests upon 8in. by 6in. transverse transoms spaced 24in. centre to centre. The footways are decked with 2in. planking laid on steel longitudinal stringers. The roadway deck is carried by eleven lines of steel joist stringers framed into plated cross girders. Cantilever extensions of these cross girders support the footway stringers. Ornamental wrought iron balustrades are provided on both footways. The roadway is carried by the bascule trusses for the full length of the anchor arm. The footway decks, however, are interrupted at the face of the pier, and the footways are carried upon the piers themselves in order to allow the anchor arm of the span to enter the pier when the leaf opens.

The bascule leaves rotate about forged steel trunnions which are supported upon a steel framework enclosed in the main river piers. The details of this framework are shown in the drawing reproduced in Fig. 3. The front main columns of this framework carry the reaction from the bascule trunnions down to concrete pedestals upon the solid floor of the machinery chamber in the pier. A second pair of columns at the shore side of each pier, supports the ends of the fixed approach spans. The front and back columns in each pier are connected by structural steel pin racks with which the main driving pinions of the bascule leaves engage. The outer halves of the front main trunnion columns are braced by steel rakers from the floor of the machinery chamber. Both the pairs of front and back columns are connected transversely by rigid bracing. Owing to the desire to restrict the size of the piers to the minimum, so as to avoid undue obstruction of the river, the space available in the piers for the accommodation of the tails of the bascule spans and the machinery counterweights and supporting steel work was extremely limited, and the greatest care was necessary in detailing this work to ensure sufficient clearance at every point.

The bascule leaves are electrically operated, and auxiliary petrol gear is provided in case of failure of the electric supply. The machinery, which was supplied by Thos. Broadbent and Sons, Ltd., of Huddersfield, is mounted on the underside of the tails of the bascule spans. The electrical supply available is three-phase, 175 volts, 50 cycles. The main turning motors are each of 50 H.P. They drive through a train of spur and worm reduction gearing to the main driving pinions situated at the ends of the anchor arms, which engage with the pin racks mounted on the pier steel work. Solenoid brakes capable of holding the span against a wind force of 10 lb. per square foot are provided on the motor extension shaft, while an additional brake of clip type mechanically operated is mounted on the second reduction shaft, capable of holding against a wind pressure of 20 lb. per square foot. The two brakes acting together are designed to hold the span against a force of 30 lb. per square foot in the open position.

Locking bolts are provided at the centre and tail ends of the bascule span and are driven through suitable gearing by electric motors of 2½ H.P. and 5 H.P. respectively. In each case a single motor controls the lock on both trusses through a cross shaft running the full width of the bridge. Provision is made for hand operation in both cases in the event of electrical failure. The travel of the locking bolts is controlled by solenoid brakes and limit switches. Auxiliary power is provided for the main turning gear in the form of a petrol driven motor mounted on the span and connected with the main reduction gearing by means of a clutch. The electrical gear is designed to open or close the bridge against a wind force of 10 lb. per square foot in five minutes; fifteen minutes are required with the auxiliary gear. Swing barrier gates are provided across the road and footways at the river ends of the fixed spans. They are interconnected with the operating gear of the bascule leaves. The whole of the control gear is situated in a cabin on one of the piers at bridge deck level. Completely automatic electrical control from a single master controller is provided, all operations being performed in the correct sequence by moving over the handle of the controller. Warning lights and indicators in the cabin indicate the actual progress of operations. The two piers are connected by a submarine cable carrying the power supply. Contactor gear and resistances are situated in separate chambers arranged inside the piers.

A 20in. diameter water main is carried under one footway of the bridge. Special gear is provided for disconnecting this main at the centre of the bascule opening, interconnected with the main operating gear. The water main rotates from trunnions situated upon the axes of the main bridge trunnions on the piers. An illustrated description of this water main appeared in THE ENGINEER of September 4th, 1931.

(To be continued.)

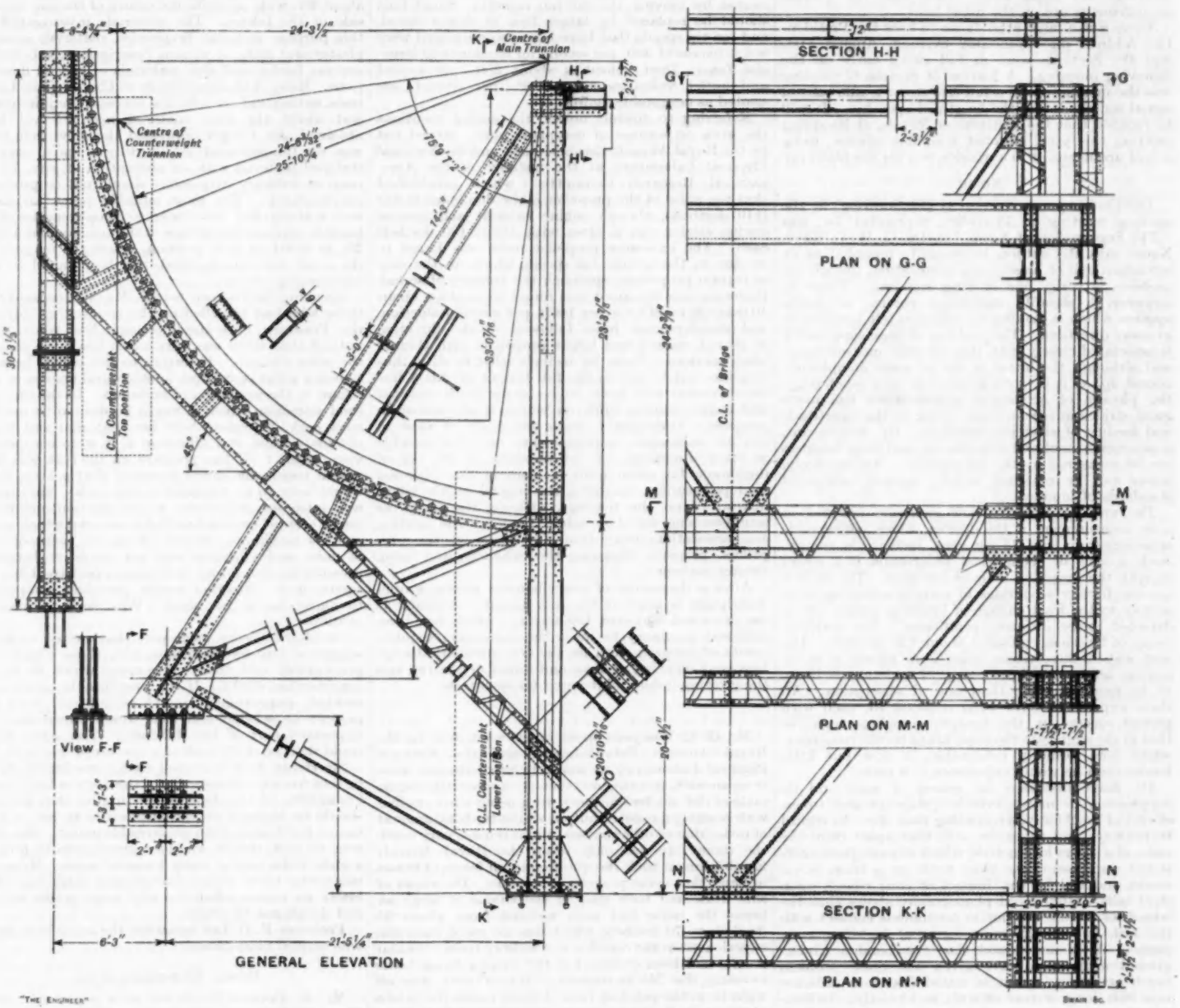


FIG. 3—DETAILS OF STEEL FRAMEWORK WITHIN THE RIVER PIERS

IBRAHIM FAHMY KARIM PASHA, Egyptian Minister of Public Works, will leave Egypt to-morrow (Saturday) for London, where he will probably invite tenders for the construction of the Gebel Aulia Dam.

The British Association.

No. II.*

ALTHOUGH the actual number of those attending the meeting this year must be about 2000, the general appearance of the City of York hardly gives the impression that the B.A. is there. There are one or reasons for this. In the first place, presumably for reasons of economy, the usual badges are not being distributed and, therefore, one does not know who are B.A. visitors or not when walking about the streets or in other places. Secondly, the streets are not signposted with indicators for the various Section rooms to anything like the same extent as is usual. Indeed, there are no such indicators at all, except on the actual buildings where the Sectional meetings are being held. Otherwise the general arrangements are on the usual lines.

There was a large attendance to hear the Presidential Address on Wednesday evening, August 31st, and the Sections were in full swing early on the following morning. A feature of Section G meeting was the installation of a full-size street traffic control signal for regulating the length of speeches. It will be recalled that the Institute of Metals, at its spring meeting this year, adopted a similar scheme, using a neat arrangement in a wooden box for the platform.

NOISE.

The first paper in Section G (Engineering) at the opening meeting on Thursday, September 1st, was "The Suppression of Noise," by Dr. G. W. C. Kaye. Noise, says the author, is generally regarded as an attendant evil of present-day civilisation, though the problem is really one of long standing. There is, however, a steadily increasing volume of public opinion which is making its influence felt beneficially in many directions. The problem of noise suppression is associated closely with that of noise measurement, and although the latter is one of some complexity, bound up, as it is, with physiology and psychology, the physics of acoustical measurement has made great strides in recent years owing to the exactitude and facility of electrical methods. By such means, noises can be analysed into spectra, and their loudness can be measured by the microphone. Alternatively, noises can be matched aurally against calibrated standards of loudness.

The unit of intensity now generally adopted in noise measurement is the decibel, which corresponds approximately to a 25 per cent. increase in energy. Such a scale of geometrical progression is a rough fit with the sensation scale of loudness. The decibel has the further advantage of corresponding approximately to the least change of loudness which can be detected under ordinary conditions. The auditory range of loudness embraces about 120 decibels. The best way of suppressing noise is to silence it at its source, failing which, a policy of isolation is likely to be more effective than one of absorption. All three expedients have been resorted to, each with partial success, in the modern aeroplane liner, so that in the aggregate the noise heard by the passenger, which was formerly intolerable, is now but little louder than he would experience in a train.

Dr. Kaye discusses the causes of noise and its suppression in motor vehicles, railways and tubes, electrical machinery, ventilating fans, &c. In regard to railways and tubes, he says that apart from the noise of a steam locomotive, which to most passengers is not unpleasant, the chief noise on a train is, no doubt, induced by the impact of steel wheels upon steel rails. High-speed photography shows that the wheels of a train are not in continuous contact with the rail, but indulge in a series of high-frequency jumps. It is understood that the London Underground authorities have given the noise problem much attention, and it is stated that new rails are now 90ft. long, instead of 40ft., as formerly. Ballasting the track between sleepers is found to help in absorbing wheel noise, but, unfortunately, impedes access to the permanent way. Rubber pads between chairs and sleepers are found to reduce the vibration, but not the noise. Shrouds or valances on the wheels have been tried with the object of muffling wheel noise, but are a nuisance in practice, as well as costly, and, moreover, are not free from risk of fire or smoke. Attention is paid to body rattles, and the banging of doors has been reduced by pneumatic closing devices. Experiments are in progress to test the absorbing effect of mattresses of asbestos or a coating of asbestos fibre sprayed on the walls of a tunnel.

As to machinery noises, among the chief causes which should receive attention in attempts at mitigation, he mentioned too high a speed (apart from resonances, machinery noises are nearly always aggravated by speeding up), unbalanced rotating and reciprocating parts, ill-conditioned or ill-designed bearings or gearing, incorrect alignment, and unstable supports.

Discussing electrical machinery, he points out that D.C. motors can now be obtained of a remarkable degree of quietness. The noise of synchronous machines is a frequent source of annoyance. Mitigation of the noise, most of which, it is stated, is to be attributed to stator vibration, usually follows from modifying the design so as to lessen the tendency for the electrical or magnetic impulses to excite resonances in the mechanical structure. The mercury-vapour rectifier has largely removed the necessity for producing quiet-running converters. As to the hum from banks of transformers, it is understood that benefit will often follow from adopting a low flux density, and by so bracing, stiffening, and damping the structural parts as to alter the natural period. Setting the transformers on cork slabs and enclosing them in soundproof enclosures with adequate ventilating arrangements, is reported to have effected a cure in some cases. Similar measures have, it is stated, also been adopted with success in the case of turbo-alternators and other high-speed rotary plant.

The problem of quietness in ventilating fans has assumed prime importance in certain cases. Apart from questions of motor noise, the noise of a fan is caused by moving the air too rapidly. Small fans should be replaced by larger fans of slower speed, and fan tip speeds that have been recommended were not in excess of 55ft. per second for medium and large-size fans. Duct velocities about 20ft. per second and outlet velocities about 30ft. per second, are quoted as acceptable figures.

Referring to aircraft noises, the author mentions the work on sources of aeroplane noise, carried out by the Royal Aircraft Establishment and the National Physical Laboratory at the instance of the Aeronautical Research Committee, which established that the noise of the propeller is the dominant factor (110 decibels), though engine exhaust and general engine clatter run it close with about 100 decibels each. The excessive propeller noise was found to be due to the terrific tip speeds which, in the case of certain propellers, approach the velocity of sound. Reducing the tip speed was found to produce about 10 decibels relief for every 100ft. per second reduction, and developments have followed in the direction of geared engines and larger propellers with thinner blade sections. Some 30 decibels relief in all is thus possible, but to derive the full benefit of this a like improvement will have to be made with exhaust and engine noises, work on which is at present in progress. Fortunately, from the point of view of the air passenger, improvements are also possible in other directions, as, for instance, in the use of duralumin for cabin walls in place of thin plywood or doped canvas, mounting the engines on the wings instead of on the fuselage, utilising the wings as sound-screens for the cabin, keeping the seating accommodation away from the plane of the propellers, properly disposing the exhausts, and using thicker windows.

After a discussion of miscellaneous noises, a brief description is given of the new acoustics building at the National Physical Laboratory, which has been rendered necessary to meet the expanding requirements of research work on the transmission, absorption, and silencing of noise and sound in general, and the growing industrial demand for such tests.

Mr. H. E. Wimperis spoke of the work done by the Royal Aircraft Establishment and the National Physical Laboratory in research into reducing noise from aircraft, pointing out that at one time the engine makers did not feel disposed to quieten their engines with possibly a reduced output whilst the total amount of noise, due to other causes, might remain very much the same. It was only when the Royal Aircraft Establishment took the question of all forms of noises in hand that some progress was made. The result of this work had been that in the cabins of large air liners the noise had been reduced from about 95 decibels to 70 decibels, which was no more than was experienced in the corridor of a railway train. Similar results had been obtained in the smaller flying boats crossing the Mediterranean. Whilst that was all right from the point of view of those inside the cabins of the aircraft, the noise was still appreciable to those outside. A great deal could be done there by cutting down the tip speed of the air screws and by silencing the engines. Speaking of other classes of noises, such as those from motor cycles, Mr. Wimperis expressed the view that it was possible from the engineering point of view to reduce them very considerably, and all that was required was an enlightened public opinion to back up definite action by the authorities.

Mr. J. S. Wilson (Recorder, Section G) said he had received some notes from Mr. Cooper, chief engineer of the London Underground Railway Company, giving details of experiments that had been and were being carried out by that company to suppress noise as far as possible on their trains. In these notes Mr. Cooper pointed out that especially in connection with new rolling stock a large number of tests had been made to determine the source of the noise on the trains and how it reached the inside of the cars. The conclusion had been arrived at that most of the noise is due to the wheels running on the rails and that it entered the coaches through the windows and ventilator openings. Experimental shrouds were fitted which completely surrounded the bogies to within a few inches of rail level and these certainly reduced the noise in the car. At the same time, however, they increased the difficulty of inspection and maintenance and less inconvenient methods had to be found. Improved ventilation reduced the need for opening the windows and improvements in the upholstery and arrangement of window spaces also had a beneficial effect. The general design of the accessory gear under the cars and the use of fibre liners and other methods to prevent rattle removed a particularly annoying form of noise. The improvement so effected, however, tended to be lost with increase of speed, noise production appearing to follow a square law. The use of rubber pads to isolate the permanent way from the concrete road bed made no appreciable reduction, but it was found that if small ballast of a particular nature was spread on the tracks to approximately rail level a considerable reduction of noise resulted. These experiments led to the view that absorption by the application of suitable substances to the track or tunnels was the best method of reducing noise. The first experiments of this nature consisted of the application of an absorption mattress in the segments at the side of the tunnels, this giving a band of absorbing material about 6ft. wide opposite the centre of the car on each side of the tunnel. The materials investigated for this purpose included fireproofed material, acoustic plaster and slabs of various descriptions, asbestos in various forms, and also materials of special descriptions. Many of these materials had been rejected after tests, as they did not fulfil the necessary requirements, and whilst the ideal material had not yet been obtained, Mr. Cooper expressed the view that there was no fundamental reason why a hard smooth-surfaced material with an absorption of, say, 75 per cent. at ordinary frequencies should not be produced commercially. The most suitable point for fixing such material had been found to be on the sides of the tunnels opposite the wheels of the coaches and a band 2ft. in width in that position, where the majority of the noise was concentrated, had been found to give encouraging results.

Speaking on his own behalf, Mr. Wilson said that those who had travelled on the new rolling stock on the Finsbury Park-Hammersmith line would have noticed that there was very much less noise than on the older coaches. Referring to the paper, he mentioned a point of interest to structural engineers with regard to the insulation of buildings. In the case of a steel stanchion which it might be desired to insulate with cork, he asked how far that material would eliminate noise and vibration if it were compressed very highly? If the pressure on the cork was kept within reasonable limits it meant that a large space would have to be occupied by the cork. That might well introduce difficulties in construction and therefore it seemed essential to find a material which would give its maximum efficiency from the point of view of noise and vibration and yet would withstand a pressure of, say, 5 tons or 2 tons or perhaps 1 ton per square inch. In other words, pressures comparable to those borne by steel. Was such a material available?

Dr. J. S. Owens suggested that noises could be separated into two divisions, viz., those which were preventable and those concerning which there was considerable doubt. If the preventable noises were tackled, improvement could be effected with our present knowledge and that would sweep away an important part of the difficulty. The other noises could then be dealt with as a matter of research.

Sir Henry Fowler moved that a resolution should be sent from the Committee of the Section to the main Committee of the Association, urging that pressure should be brought on the authorities to set in force means for dealing with preventable noises. His point was, he said, that it was now practicable to produce a great reduction in many forms of noise. Means for measuring those noises existed and there was absolutely no reason whatever why some action to that end should not be taken.

Professor F. C. Lea seconded the resolution and it was carried unanimously.

RURAL ELECTRIFICATION.

Mr. R. Borlase Matthews, in a paper on "Rural Electrification and the Grid," points out that 320 authorised electricity undertakers are concerned with supplying in rural areas, but for various reasons the farm load has been comparatively neglected. The fact that the grid ensures a low price for current at the smaller centres should facilitate rural development. Of a total of 88,000 square miles in Great Britain, upwards of 81,000 square miles, or 92 per cent., consists of rural districts in England and Wales or extra-burghal districts in Scotland; but the population of these districts is only 22 per cent. of the population of the whole country, and the density per square mile is only 115, as compared with the average density of 4900 inhabitants per square mile in the urban and burghal districts of Great Britain. Even this low rural density, however, is much higher than that on the Continent in areas where electricity supply is a success.

Undoubtedly, during the early years it will not prove remunerative to supply from 30 to 40 per cent. of the rural areas of Great Britain, owing to the infertile nature of the soil, &c. The best load will be obtained in those areas where there is a large percentage of arable land, though good pasture dairy farming centres may be made very attractive. A good general rule, based on the experience of those responsible for large rural schemes, is that if one-fourth of the area of the land is arable an electricity supply can be provided safely and will prove profitable to the supply undertaking. In connection with the

* No. I. appeared September 2nd.

villages, those of under fifty buildings are generally dependent upon the local farms and are not very attractive from the supply point of view, as the occupiers are not usually well paid. In conjunction with the surrounding farms, however, they are worth considering, and when they happen to be on the route to other larger villages the cost of a supply is proportionately small. Independent investigators have found that the average labourer can afford to spend 1s. 6d. per week, *i.e.*, £3 18s. per annum, on electricity. Such a figure will not allow for much more than lighting. In rural districts it is safe to estimate on a consumption of about 40 units per annum for lighting only, and such apparatus as might be used at lighting rates.

About 50 per cent. of the electricity supply undertakers to-day are authorised to give supplies for all purposes in rural areas. A census made by the Electricity Commissioners in 1930 disclosed that over 82 per cent. of the rural population resides in areas for which distribution powers have been granted. The tendency to look upon the farm as of less importance than even domestic supply, said Mr. Matthews, has much to do with the present backward state of rural development. Many undertakers cannot or will not see that if the greatest possible rural development is to be obtained an area must be considered as a whole and due regard paid to the individual loads to be obtained from farms, villages, &c., in the area. This can only be done by proceeding on the basis of carefully planned schemes of transmission and distribution that will provide for a supply to practically every building in the area.

Some particulars of the Mid-Lincolnshire rural electrification scheme are given as an example, and to show the general principles associated with the supply of rural areas. The area covered is approximately 1600 square miles. The voltage decided upon is 11,000. The economic radius of an 11,000-volt line is 10 miles; hence each electrical district should cover an area with a radius of 10 miles from the central distributing point. The distribution is at 400 volts. The extent of the preliminary development from the 11,000/400-volt transformer station will be an area with a radius of 600 yards; hence the 10-mile area should be so divided up as to obtain the information necessary to determine whether such an area can be successfully developed. Under this scheme supplies of electricity are to be taken from the Central Electricity Board from nine points.

Pointing out the varied uses for electricity on the farm, Mr. Matthews urges that an efficiency engineer should be put on to the job. At present, he says, farming in this country is to a great extent either a peasant industry or a rich man's hobby; it is certainly not a business in the best sense of the word. In a number of parts of England farm consumptions already reach from 10 to 20 units (kWh) per acre, which is quite attractive from the point of view of the electricity supply undertaking. But this figure should be considerably exceeded, to the mutual advantage of both parties concerned. He welcomed the action of some British electrical manufacturers, who are forming special departments to cater for farm requirements—an action which was long overdue. It would do much to help electricity undertakers in providing their farm consumers with adequate equipment, but before the farmer would purchase such equipment the supply undertakers must make a determined effort to enlighten these consumers concerning the advantages of electricity, and at the same time have available a supply of electricity at a reasonable price. This would involve the problems of propaganda activities and tariffs.

With regard to the latter, he emphasised the necessity for a low charge per unit. The guarantee of a minimum contribution from agriculturists should, except in very isolated districts, be dispensed with, as such a practice has done much to retard the growth of rural development schemes.

Finally, in a reference to the enormous possibilities of electrical development in connection with farming, he says that in the whole country there are 418,000 farms, but on only 4000 of these is electricity being used. Some six years ago, however, there were only about 600 farm users of electricity, so that the increase has been really very rapid. If electricity were used on all our farms, even on the basis of less than the present use of power, the agricultural consumption would be greater than that of all other industries in this country put together.

Mr. W. B. Woodhouse (Yorkshire Electric Power Company) suggested that the author had not given the power companies full credit for what they had done in regard to rural electrification. A point to be remembered was that if the country went in for prairie farming the demand for electricity would not be very large. It was possible for one or two men to work 1000 acres under those conditions and the amount of electricity used would be of the order of 10 or 20 units per acre. In the case of figures relating to 300 farms which his companies were supplying, and which averaged 150 acres each, the consumption was about 1500 units per annum, the revenue being about £11 per annum, or approximately 1¾d. per unit. Even that was not a tremendous development, and it seemed to him that it was necessary to proceed with caution in regard to rural electrification. To some extent, therefore, the prospect held out by Mr. Borlase Matthews must be accepted with a certain amount of reservation. The figures relating to two villages served by his companies, in which every house and building was electrically equipped, showed a revenue of 7·6 per cent. and 10·6 per cent. of the capital expenditure respectively, the revenue per head of population being 26s. and 29s. per annum respectively. As a matter of fact, for a rural area those were very good figures, but the fact remained that the purchasing power of those in rural areas was very low and, speaking broadly, it could not be said that the prospects were very considerable. The whole question came down to one of cost of distribution, and although compulsory wayleaves had helped considerably, there were still difficulties in the matter of overhead construction. There was also the question of rating which, in some cases, amounted to as much as 13 or 14 per cent. of the total revenue. Some concessions in that connection were necessary if the development of rural electricity supplies was to proceed as was desired.

Dr. C. C. Garrard agreed with Mr. Woodhouse that for rural electricity supplies to be successful it was fundamentally necessary that they should be cheap. Naturally, overhead lines and outdoor type switch stations must be used, but a matter which had recently come under his notice was the extra cost of transformers on poles which would come about if those poles and transformers were regarded as "premises" within the meaning of the Home Office factory regulations. Whilst being the last to resist the application of any regulations for the safety of the public or workmen, he failed to see a reason for bringing such poles and transformers within the Home Office regulations. They were not used by anyone except the skilled workmen concerned with the work, and large numbers of such apparatus had been in operation quite satisfactorily and without incurring risks for a long time. He suggested that a definite decision should be given by the Electricity Commissioners, after inquiry, on that matter as soon as possible.

Mr. G. Wilkinson (late Chief Electrical Engineer, Harrogate Corporation) agreed that the whole question of supplying rural areas boiled down to one of cost. The farmer at the present time had little money, but the cost of electricity to-day was higher than it should be for the reason that the national scheme was costing a great deal more than had been estimated, and the time would come when, instead of interest being paid out of capital, it would have to be met by those taking supply, in addition to the costs of the expensive staffs being maintained by the national authorities in connection with the scheme. For that reason, he believed that there would be a rude awakening in the near future. Therefore, it was essential to devise means for selling electricity in larger quantities than hitherto if the use of it was to increase more rapidly than hitherto. Efforts must be made to get business at load factors above the usual 20 or 25 per cent. loads with 60, 70 and 80 per cent. load factor, that could only be obtained by the adoption of thermal storage. He suggested, therefore, that in order to encourage rural and other electricity supplies additional methods of heat storage, better methods of heat control and co-ordination between the hand-switch and the heating load were needed. In his own house, said Mr. Wilkinson, he used cast iron for thermal storage in such a way that when lighting was switched on a certain amount of supply was taken automatically from the heating or *vice versâ*. By such means the load was kept relatively steady, and it would not be necessary to have expensive apparatus at supply centres for the regulation of pressure.

There was no time for further discussion, but at the close of the meeting, Mr. Borlase Matthews exhibited a film showing some of the equipment on the Mid-Lincolnshire scheme, and also a few features associated with electric farming in Czecho-Slovakia.

Electric Ship Propulsion.

The final paper on Thursday in Section G was one by Dr. C. C. Garrard, on "The Electric Propulsion of Ships." The author emphasises the point that he does not set out to prove the economic advantage of electric ship propulsion. The fact that, excluding war vessels, the ships built or building with turbo-electric propulsion have a total shaft-horse-power exceeding one million, and oil engine vessels with a total of more than 100,000 H.P. renders such proof unnecessary; 90 per cent. of these vessels have been built in the United States, a fact attributed in part to the stimulus afforded by the adoption of electric propulsion for the capital ships of the American Navy. The recent reversion of the U.S. battleship "New Mexico" to geared turbines was not due to any dissatisfaction with the electrical equipment, but for quite other reasons. The decision to adopt electric propulsion for any vessel is not so much a question for the electrical engineer as the naval architect, who must take into account the whole of the ship as a means of transporting passengers and merchandise. The effect upon the revenue-earning capacity is more important than the reduction in fuel cost. In the case of liners, generally speaking, electric propulsion results in greater efficiency, whilst for vessels of the self-unloading type which require a large amount of power in dock, it is a necessity. In other cases, the ease of control and manœuvre is a determining factor. With electric propulsion, bridge control is possible and the paper advocates the greatest possible use of automatic control, maintaining that the great reliability such gear has shown in land practice will be repeated at sea.

The propulsion equipments of the "Viceroy of India," the "Monarch of Bermuda" and the "E.M.V. Cement Karrier," are considered in some detail, as well as the various systems of electric propulsion and the circumstances which determine a choice between them.

The President said there were so many advantages to be obtained from electric propulsion that the slight loss of efficiency between generator and motors was far more than compensated for in many cases by the convenience in the placing of the prime movers, and in many cases there was an actual gain in efficiency where various speeds were required for the ship. It was interesting to note how fast that work was developing, partly under the ægis of the General Electric Company, in this country.

Mr. S. V. Goodall (Royal Corps of Naval Constructors) said that so far as warships were concerned he could not say anything extremely polite on the subject of electric propulsion. By the courtesy of the United States authorities he had spent a considerable time in the "New Mexico." The machinery there had worked extremely well, and the Naval Authorities were quite satisfied with it. But the fact that that machinery was being replaced by geared turbine machinery was, at any rate, not a very great argument in favour of electric propulsion. Of course, as Dr. Garrard had said, the "New Mexico" was not designed for the electric drive, and the later ships which were designed for it had enabled the naval architect to improve the lay-out of the machinery, particularly with a view to protection against torpedo attack; that was one of the great advantages claimed for the adoption of electric propulsion. But it was quite possible to lay-out a ship with efficient protection against torpedo attack, and at the same time to use geared turbine machinery, so that the question of electric drive *versus* geared turbines had to be considered, in his opinion, from the point of view of the relative efficiencies of the two systems. So far as he knew, the electric drive was heavier and occupied more space than the geared turbine, and in that respect the former suffered grave disadvantages for warships, particularly since recent treaties had introduced the displacement limit. As to the application of electric propulsion to merchant ships, he agreed with Dr. Garrard that the overall question of the advantage of the system of drive in the particular ship and the service for which the ship was intended must be considered. Dr. Garrard had proved that there were many services in which the adoption of electric propulsion would be found to have economical advantages.

There was no time for further discussion, and the Section adjourned until Friday, September 2nd.

In Section G (Engineering), on Friday morning, September 2nd, the President (Professor Miles Walker) delivered his presidential address. Some excerpts from it appear on page 260.

Soviet Enterprise.

Mr. A. P. M. Fleming, in a paper entitled "An Engineer's View of Soviet Enterprise," remarks that the suggestion made by the President that the abilities of those who are engineeringly minded and experienced in engineering affairs should be utilised in the solution of the difficulties with which the greater part of the world is faced had led him to think that the occasion was opportune to survey the principal features of the Soviet enterprise in the well-known five years' plan and the forthcoming second five years' plan. He does not consider in any way the U.S.S.R. political plans as they affect the rest of the world, but, from the point of view of an engineer, surveys those aspects of the enterprise which are noteworthy in connection with ways and means of dealing with the economic problems now confronting the rest of the world in the hope that they may suggest some means whereby the experience gained in this great Russian experiment could be utilised for the achievement of the same objective, but under the entirely different conditions which apply in capitalist countries. He reminds his readers that Russia occupies one-sixth of the land area of the globe and contains 147 million people of 200 nationalities. The natural resources, with the exception of rubber, are all that are required by modern civilisation. Climatic conditions are in places of the severest and subject to the greatest extremes with the corresponding effect on the possible working periods. Road and rail transport is largely limited to the principal existing industrial centres and there is very little ice-free seaboard. Until the last decade 80 per cent. of the population was illiterate and almost entirely unskilled as regards the manufacturing industries. The result of the revolution was to place in authority a group of leaders determined to make the U.S.S.R. economically

self-contained by the development of the great wealth of natural resources and, in a comparatively short period of time, to raise the standard of living to not less than that of other countries. To achieve this aim the standard of living of the present generation, it was recognised, must be very low, since 50 per cent. of the national income is being withdrawn from consumption and used to finance new productive State enterprise—all private interests being suppressed. In contrast to capitalist countries, girls and boys are trained, and men and women worked side by side on the same jobs in every type of labour. Up to the present there is great enthusiasm for the scheme on the part of the people. Whether that will remain and continue, however, when the general position of the country becomes easier is a matter that time alone can decide. One reason at the moment for that enthusiasm, probably, is the fact that the bulk of the population has no free contact with other countries.

The main feature of the U.S.S.R. national economy is the planning of both production and trade under a single system. That planning has been concentrated in the State Planning Commission and the Supreme Economic Council is the special controlling Commissiarat responsible to the State Planning Commission for regulating, supervising, and administering industry and the trades directly concerned with it, and is responsible for carrying out the much-discussed five-year plans. During the present year the Supreme Economic Council has been reorganised into three groups dealing respectively with the heavy industries, the light industries, and the wood and timber industries. Those groups are again subdivided into separate sections, one dealing with generation and transmission of power, another with supply apparatus, &c. Manufacturing is entirely in the hands of the State combines, which report to the appropriate section of the Supreme Economic Council. In short, the industrial position in Russia now is that there is only one producer and one customer—the State—so that all questions of expense of selling, profit-taking at various stages between the raw material producer and the production of the finished article, and profits to the consumer are cut out, as also are profits on transport. Thus, in producing fabricated articles, chief attention can be directed to their economic production, and without the need for a high degree of finish or such additions to finish as may represent selling points under a competitive system. Production can be on definitely standardised lines, again resulting in considerable economy in the first cost of production.

In general, labour is not very efficient. For mass production the unskilled labour could quickly be trained to the necessary degree of efficiency, but where manufacture requires individual skill and effort, as in the case of steam turbines and the bulk of electrical machinery, the output per worker is probably of the order of 50 per cent. of Great Britain or America and probably some castings, for example, would be rejected in this country on appearance alone.

Generally speaking, Russia is on a war footing, *i.e.*, the standard of living being at the lowest level of subsistence practicable, while all possible resources are being used to build up the productive facilities. There are about 12 million industrial workers, as compared with 2 million in pre-war days, and factories employ as far as possible not less than 50 per cent. of women and in some cases 60 per cent.

Most of the weaknesses that visits to Russia disclose, says Mr. Fleming, are remediable. For example, the tremendous expansion of industry inevitably introduced much inefficiency of working, and there are some questionable features of quality which may react under service conditions. There is a lack of suitable men of the non-commissioned officer type in industry, but this and other matters will, no doubt, be remedied in time. At present the factories work seven hours a day and office workers about six hours, four days out of five being working days.

Since Lenin's slogan was "Electrification plus Soviets=Socialism" it was not surprising that the first five-year plan aimed at raising the economic status of the country by the rapid development in the first place of the heavy industries, and particularly the electrical industries. The year 1931 witnessed the completion of the first phase of the process of electrifying the Soviet Union. The output of the electric power stations was 7700 million units, which it is estimated to increase to 12,500 million units in the present year, and this increase will be made possible because the total capacity of the stations will be augmented by 1,500,000 kW. The two main objects of the 1932 developments are, firstly, hydro-electric stations which will be used largely for the metallurgical industries; and secondly, the construction of central electric heating stations. Electricity is the fundamental basis of the development visualised under the second-year plan, and the success of the plan is dependent on the creation of a modern power base founded on the electrification of transport and industry and the application of electric power to agriculture. Thus it is hoped that by the end of 1937 an output of 100,000 million units will have been reached.

Among the other proposals of the second five-year plan are: (1) The construction of 30,000 kiloms. of new railways and several score of bridges; (2) an increase in the yearly output of coal to 250,000,000 tons; (3) an increase in the output of pig iron to 22,000,000 tons; (4) to increase the output of the machine building industries three and a-half times; (5) an increase in the output of oil by two and a-half times. New and more powerful locomotives are to be introduced, larger goods trucks, several railway lines are to be electrified, the mercantile marine is to be reconstructed and ports extensively improved, new roads are to be built, air lines still further improved, wireless communication extended, and the production of non-ferrous metals is to be so developed as to supply the home needs in copper, lead, zinc, aluminium, and the rare metals. The development of the chemical industry is to aim primarily at increasing the output of fertilisers and basic chemicals.

Mr. Fleming gave some details of the Dniepr Combine in the Ukraine as a typical example of what is being done and what is to be still further developed under the five years' plans. A "Combine" is primarily located at some large inexpensively exploited source of power in the vicinity of mineral wealth and good agricultural soil, involving the migration and settlement of a vast population of industrial and agricultural workers. In the case of the Dniepr scheme the nearest point of consumption of the electric power produced there is the important coal-field of Donbass, 150 miles away, and it is proposed to utilise the main bulk of the output at a new city which is being built near the dam. The output is estimated in a dry year at 2500 million units and in a wet year at 4410 million units. The annual capacity of the plant has been set at 1,130,000 tons of metallurgical coke and about 100,000 tons of smaller sized coke, the plant consisting of four batteries of sixty-nine ovens each. The blast-furnaces will receive the gas of the coke ovens only after it has gone through the by-product plant.

The steel plant will specialise in high-grade steel, and the annual output is estimated at 1,250,000 tons. The ferro-alloy plant will have an annual output of 80,000 tons of ferro-manganese, 20,000 tons of ferro-silicon, 4000 tons of ferro-chromium, and 1600 tons of ferro-tungsten. The aluminium works will have an annual capacity of 20,000 tons and consist of an oxide plant, an electrolytic plant, and the electrode plant. In producing annually 1,800,000 tons of pig iron the blast-furnaces will yield during the same period up to 1,000,000 tons of granulated slag for the manufacture of cement and slag bricks. The annual capacity of the various enterprises is put as follows:—Slag cement, 2,600,000 barrels, 30,000,000 bricks, 20,000 tons of lime, and 150,000 tons of fire-brick.

The opening of the hydro-electric power station and of the majority of the units of the Dniepr combine is scheduled for 1932, but the sheet rolling mill will not be opened before 1933.

Reverting to the inefficiency of the labour at present available, Mr. Fleming says this is clearly realised and great efforts are being made to increase the skill of the workers by means of a campaign now being carried on to make even the peasants "technically minded" and to instil in them the rudiments of craftsmanship. The Soviet Union had also set up a State Scientific Council to establish a single system of educational supervision and control over scientific and educational institutions. The fullest possible support is being given by the Soviet authorities to the fostering of scientific work, and this is supported by lavish expenditure of money and equipment. In pure science many new laboratories are being erected at different centres, and in applied science each industrial centre has its central laboratories. For the moment, however, progress in pure science seems to be ahead of progress in applied science, another condition which will correct itself in time.

Having noted some of the plans and achievements of the Soviet enterprise, Mr. Fleming draws a few comparisons between the conditions existing in the U.S.S.R. and those of the principal industrial countries. He points out that whilst operating under the advantage of a concentrated control of all its functions of Government and possessing inherently practically all the raw material resources it needs, the U.S.S.R. is handicapped by the fact that these resources are largely undeveloped and that at present means for converting them into more useful commodities is entirely inadequate. Climatic conditions are not generally favourable; internal communication is inadequate; the people as a whole are not yet educated, although the 80 per cent. illiterate is claimed to have been reduced to 40 per cent.; there is a lack of industrial *personnel* and experience, but, withal, an intense enthusiasm on the part of a very active section of the population backed by very clever and extensive propaganda directed to encourage the people to achieve the plans arranged despite the hard conditions and a very low standard of living.

This enterprise, which after all is only large-scale organisation, presents features which cannot easily be judged in the light of the experience of other industrial countries, nor can any forecast of the success of the enterprise be made until the plans are more advanced. Certain comparisons, however, suggest themselves, says Mr. Fleming. For instance, will the creative impulse of competitive conditions such as we in this country are accustomed to—with their stimulus to progress on the one hand and their wastefulness through overlapping on the other—be more effective than the progress achieved where the creative impulse of competition is replaced by the enthusiasm for achievement and an almost fanatical desire to prove by results the merits of the Soviet system? To what extent does the absence of vested interests constitute a serious advantage over conditions where vested interests are a predominant feature of national existence? How does the absence of internal tariff barriers coupled with a Government activity for the most part concerned only with its internal affairs and the development of its own resources contrast with the conditions of most industrial countries which are not self-supporting, which have to carry on international trade in a variety of currencies, hampered with all kinds of artificial trading barriers and also in which the Government is very largely concerned with international rather than with national affairs? In considering these contrasts, continued the author, one can hardly escape the conclusion that self-supporting units will become an inevitable development of the future and that countries will have to adapt themselves either through treaty or trading or geographical position so as to become economically self-supporting without necessarily precluding inter-trading with other similar units. In this respect the British Empire would appear to be an ideal economic self-supporting unit. In this work the Soviet started with the advantage of a clean sheet devoid of preconceived ideas and prejudices and the handicap of long-established and often obsolete methods. That the U.S.S.R. recognised these possibilities is shown by the great attention that is being paid to the fostering of scientific development, to the building up of an immense scientific *personnel*, and to the vast expenditure on scientific laboratories and equipment. The scheme has been criticised from various points of view, and it has been said that it has not achieved what it had set out to do. Personally, says Mr. Fleming, he does not think the question of the plan succeeding within a given time need be considered. It was impossible not to appreciate that a great deal has been accomplished, quite apart from the question of whether the principles are fundamentally right or wrong, and considerable progress has been made in the face of the greatest difficulties. The tendency during the past few years has been to view the Soviet enterprise much in the light of what each individual thinker hopes may happen to it, and for the most part hopes had been centred on its failure. It would, however, be more rational to adopt the view that this great experiment is worthy of the closest study, and just as in the solution of their great problems the Soviet has examined critically and utilised fully the experience and *personnel* of other countries, so also we of the other industrial countries might well profit from the success and failures of the U.S.S.R. in the solution of the problems, national and international, that beset us.

Sir T. Hudson Beare said it was extremely difficult to get at the real truth of what is going on in Russia at the present time, because the statements in the daily papers were so often garbled through political animosities, and, therefore, it was very hard to obtain any idea whether this enormous industrialisation of what was an almost purely agricultural population was going to be successful or not. Mr. Fleming had convinced his audience that whatever mistakes had been made—and they were bound to be made—there had been enormous development and progress under the Five Year Plans. It would, indeed, have been surprising if mistakes had not been made, seeing that the Russians were trying to accomplish in five or ten years what other countries had taken 200 years to accomplish. The success of the major part of the work he did not think could be disputed, although whether the world would be happier by the industrialisation of a great agricultural population was a debatable problem. A country like Russia, however, with such enormous natural resources, could not remain simply a producer of primary products. She was bound to develop her manufacturing industries, and with the progress of education among her people the nation was bound to develop in time as had other nations in Western Europe. Therefore, it behoved us, as an Empire, to watch carefully what was going on, to discard all political ideas on the question, and to look simply on the industrial development contemplated which would make Russia one of the great States of the world.

Mr. R. W. Western remarked that the experiment in Russia had been conducted by people of extraordinary ability and undoubtedly with a spiritual inspiration, because, without such an inspiration and the highest ideals, the people would never have been able to hold together in all the difficulties that had been encountered. There would have been no bond which would have prevented them cutting each other's throats long ago. That ideal was the elimination of the motive of private gain. The issue was whether a nation could be organised on a basis that the workers would continue to work without any desire to improve their position in the world, but with a desire to achieve something for the benefit of their country as a whole. He wished them every success in that effort.

Dr. J. S. Owens suggested that the success so far attained with the Russian experiment was due either to a desire to improve the condition of the country and their own conditions at the same time, or the fear of punishment. It was a question whether if these factors did not exist there would be the same

inducement to do what the workers were now doing. After all, it was the individual who produced the original idea, and he rather felt that these original ideas would not be forthcoming under the Russian scheme.

Mr. R. McGregor said that although Russia was making a great experiment, it was not a voluntary one. It was being carried out by forced labour at the instance of a few better educated people, who had been able to do it because the population as a whole was so scattered that it could not combine to resist. If things were so successful in Russia, why was the country closed to all except those who were taken to see what the Russian Government wished them to see.

IMPACT TESTING.

At the close of the discussion on Mr. Fleming's paper, Professor R. V. Southwell, F.R.S., gave an account of some work he has been doing at Oxford to improve the technique of impact testing. In view of the fact that the subject is shortly to be dealt with in a paper before the Institution of Civil Engineers, Professor Southwell specially asked that his remarks before Section G should not be reported.

NOISES IN ELECTRICAL MACHINES.

Dr. F. W. Carter, F.R.S., then presented a paper on "Magnetic Noise in Dynamo-electric Machines." This paper, which is essentially of a mathematical character, deals with vibrations in dynamo-electric machines caused by the movement of the magnetic field with the rotor of the machine, and particularly such as result in the objectionable howling noises which certain machines emit. The vibrations are shown to be due to one or other of the members having a toothed magnetic structure which causes periodic vibration in the field and, consequently, in the mechanical traction on the structure. By mathematical treatment the conditions favouring vibration are elucidated and the relation between the frequency of vibrations and the numerical data of the machine determined. It is shown, moreover, that certain harmonics in the periodic magnetic forces which act on the teeth are essential to the vibration, and methods for computing the forces are discussed, particularly in their application to synchronous machines. In an appendix a comparison is made between two machines from the point of view of vibration, and it is estimated that one has some eighty times the potency of the other in producing sound. In a second appendix, certain features of the sound from travelling wave sources are discussed, and it is shown that the sound produced is not effectively broadcast unless the pulse of distortion which produces it travels around the machine with speed greater than that of sound in air.

CLEAVAGE OF TIMBER.

The final paper in Section G on Friday morning was one by Professor E. G. Coker, F.R.S., and Dr. Ruth Levi, on "French and British Cleavage Tests of Timber." The authors point out that the need of maintaining a sufficient supply of useful timbers is a matter of world-wide importance, and that the numerous scientific and other questions that arise have led to the establishment of a number of State laboratories for the study of these problems. Among these, the mechanical properties of timber take an important place, and numerous standard tests have been devised which are in process of co-ordination, in order that the results from all sources shall be strictly comparable. This co-ordination is especially difficult for a material like timber, which has unlike properties in different directions, and although the grain of the timber is one of its most prized characteristics, yet its presence renders a scientific classification of its mechanical properties a task of the utmost complexity. At the suggestion of Sir Alfred Ewing many of these timber tests have been investigated by photo-elastic means, using transparent and isotropic materials. This procedure affords stress distribution of more simple types than occur in actual test members of anisotropic bodies like timber. Nevertheless, they afford considerable aid in ascertaining the actual nature of the practical tests employed, and also help to explain some of their anomalies. Cleavage tests are usually made on notched specimens of timber so designed as to ensure fracture along the grain at a place of minimum cross section. This does not always happen, and photo-elastic investigation of French and British standards prove that the minimum cross sections are not places of maximum stress intensity. The paper describes these experimental observations in detail, and shows that the various cleavage tests now made are not properly co-ordinated. The suggestion is made that a better form of test might prove to be a simple tension test with the grain of the timber arranged perpendicularly to the line of the load.

(To be continued.)

BY using duralumin in the construction of the hoisting skips and cages of the Rand mines, it has been found possible to increase the useful load by a ton without increasing the stress in the rope, so that the skips now take 5 tons.

Double 50in. Centre Lathe.

WE recently had an opportunity of inspecting a large double lathe of unusual design, built by Craven Brothers (Manchester), Ltd., of Reddish, near Stockport. It is illustrated on page 258. The machine has 50in. centres and comprises two single lathes on one bed, the face plates of both driving headstocks facing inwards, and the loose headstocks being placed midway on the bed, back to back. This arrangement permits of the operator's position being normal for either lathe. For convenience of description the left-hand end of the machine in the illustrations is referred to as the main, and the right-hand end as the secondary lathe. The left-hand driving headstock only is used when operating the machine as a single long lathe, one loose headstock being removed and the other run up to the right-hand end of the bed. Six saddles are provided, three at the front and three at the rear, arranged as follows:—In the main lathe the two front saddles have swivel rests and one rear saddle a non-swivelling rest; in the secondary lathe, of the two front saddles, one has a swivelling and one a non-swivelling rest and one rear saddle has a swivelling rest. When the machine is used as one long, single lathe capable of admitting 32ft. 6in. between the centres, the six saddles may, of course, be used as desired, the rear saddle on the secondary lathe becoming a front saddle by removing a packing piece, and, similarly, the front saddles of the secondary lathe becoming rear saddles by the addition of packing pieces. The necessary placing of the various components for use as either one or two lathes is easily carried out.

The bed is of the four-shear pattern, composed of four sections accurately jointed and having overall dimensions of 112ft. in length and 9ft. 9in. in width. The driving headstocks are of the totally enclosed type, having a spindle speed range from 0·625 to 19·3 revolutions per minute. The spindles are 18in. diameter at the front neck and are of forged steel, running in parallel capped bearings and fitted with multi-collar thrust bearings. The gearing throughout is of steel, the final drive being by spur pinion supported on both sides and meshing with a gear ring of large diameter on the face plate. Levers are conveniently arranged on the front of each headstock for making the various changes of gear.

The face plates are 8ft. diameter and are carried on a spigot and flange forged solid with the spindles. They are fitted with four massive heat-treated steel jaws carried in steel slides and operated by screws and a ratchet lever. Mechanical lubrication is provided to all the bearings in the headstocks, and to prevent the ingress of dirt a filter is introduced into the oil circuit. In addition, a cascade oiling system gives a continuous flow of lubricant to all the gear teeth.

The main drive is by means of variable D.C. motors of 250–750 revolutions per minute, the motor which drives the main headstock giving 75–200 horse-power, and that which drives the secondary headstock 75–120 horse-power. These motors are mounted on base plates on the end of the bed as shown in the illustrations, and drive the spindles through Bibby flexible couplings and four sets of gearing. In each of the headstocks a tachometer and ammeter are fitted, and electrically lit inspection windows are provided to view the oiling and gearing. A push-button station is fitted to the headstocks with "stop," "start," "inch," "accelerate" and "retard" positions indicated.

Each saddle has a self-acting surfacing motion through a screw and nut, a self-acting sliding motion by rack and pinion, and hand and quick-power traverse along the bed, the last-named being operated by means of separate and independent flange mounted motors. All gearing for obtaining the six sliding and six surfacing feeds is within the apron.

The saddles fitted with swivelling slides have a longitudinal power feed to the top rest, enabling short tapers to be dealt with when desired. Push-button control stations are arranged on each saddle. These control both the main motors and the quick-power traverse motors, switches being fitted to the secondary lathe control stations to enable them to be used for operating the main or secondary headstocks according to whether the lathe is used in its single or double capacity. Each of the saddles has a one-shot oil pump, which draws its supply of lubricant from a tank in the apron for the bearings.

The feed shafts which actuate the sliding and surfacing feeds to the saddles are arranged on each side of the lathe. It will be realised that both front and rear feed shafts must be capable of being used either as one long shaft driven from the main headstock when using the lathe as a single machine, or as two independent shafts driven from the main and secondary headstocks respectively when acting as a double lathe. This has been arranged as follows:—Each headstock drives its front feed shaft through a gear-box, a cross shaft being run out of this gear-box through the bed to drive the rear feed shaft. The front feed shaft may be engaged or disengaged at the gear-box at the same time disengaging the rear feed shaft drive, which may also be disengaged independently if desired. The ends of the four feed shafts are held in auxiliary bearings at the centre of the bed, and each length of shaft is supported by three self-acting tumbler bearings. In order to use the machine as one long single lathe, the feed drive is disengaged at the secondary headstock end, and the front and rear secondary feed shafts are moved along and jointed to the main shafts in the customary way, the auxiliary bearings afterwards being drawn back to allow the saddles to pass over the joint. The feed shafts are then driven by the main headstock in the manner previously described.

The loose headstocks may be set over on their intermediate plates for alignment purposes, and are arranged with a steel revolving spindle moving in parallel bearings with multiple-collar thrusts. Each headstock has a 7ft. face plate having four steel jaws. The spindles are provided with inner sliding barrels, adjustable endwise by means of a screw and suitable gearing, which is hand-actuated. Hand and quick-power traverse along the bed is provided, the latter being by separate flange-mounted motors. All the rotating parts are enclosed and mechanical lubrication is provided to all bearings.

The machine is provided with two four-point stationary stays and two roller stays, the latter being arranged with two intermediate plates for height setting.

The principal dimensions are as follows:—

Height of centres	50in.
Length of bed	112ft.
Will admit between centres (when used as a double machine)	32ft. 6in.
Ditto, when used as a single machine	75ft.
Will swing over saddles	80in.
Width of bed	9ft. 9in.
Diameter of spindle neck, front	18in.
Diameter of faceplate	8ft.
Range of spindle speeds, r.p.m.	0·625 to 19·3
Six sliding feeds	
Six surfacing feeds	
Approximate net weight of lathe, less electrical equipment	260 tons

The following are the particulars of tests made on the secondary lathe:—On 40-ton steel shaft, 23½in. diameter by 22ft. 2in. long, one end gripped in the chuck and the other end held in the chuck jaws of the loose headstock, the bar being supported in the centre by a four-point stay; cut, 1½in., divided between four tools, each tool taking a cut of ⅛in.; feed to each tool (front) being ⅛in., and to each tool (back) being ¼in.; cutting speed, 7 r.p.m. (42ft. 6in. per minute) giving 151 cubic inches of metal removed per minute.

A high-speed test was also taken as follows:—Cut, ½in., divided between two front tools, each tool taking ¼in., the feed to each tool being ⅛in., and the cutting speed 14 r.p.m. (85ft. per minute), giving 85 cubic inches of metal removed per minute.

The lathe forms part of a large order for machine tools for the Russian Government for use at Donetsky, near Kharkov, in the Ukraine.

250 B.H.P. Convertible Gas or Oil Engine-Driven Gas Compressor.

THE illustrations on page 254 show a 250 B.H.P. five-cylinder vertical engine designed to run on either natural gas or heavy oil, coupled to a Reavell gas compressor, which was recently supplied to the Anglo-Ecuadorian Oilfields, Ltd., by the National Gas Engine Company, Ltd., of Ashton-under-Lyne. It is to be installed at the company's oil fields in Ecuador and will be used for pumping back into the oil-bearing formations the natural gas which, along with the oil, is obtained from the oil wells.

We believe that this is the first all-British gas compressing unit to be supplied for natural gas pumping or for the similar purpose of raising oil by a gas lift. The set is designed to perform a dual duty of delivering either 1,500,000 cubic feet of gas per twenty-four hours, compressed to 130 lb. per square inch, or alternatively 600,000 cubic feet per twenty-four hours delivered at the same pressure, the variation in duty being accomplished solely by altering the speed of the engine. To meet these conditions a special governor was designed, and gave very satisfactory results in the speed control trials to which we later refer.

ENGINE DETAILS AND EQUIPMENT.

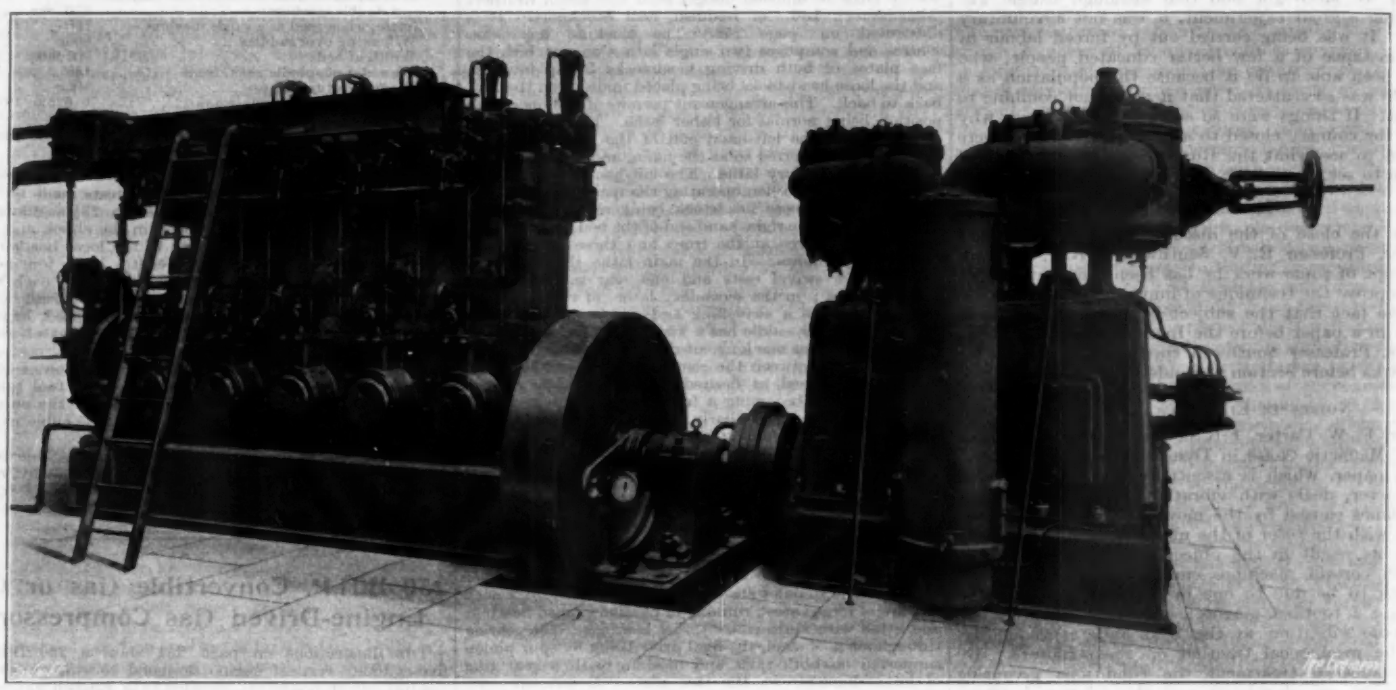
The engine has a designed output of 250 B.H.P. at continuous load rating, and 275 B.H.P. maximum load when running on natural gas, having a calorific value of 1100 B.Th.U. per cubic foot or, alternatively, an output of 275 B.H.P. continuously and 302·5 B.H.P. maximum when supplied with fuel oil of 18,000 B.Th.U. per pound. The above mentioned powers are those developed at sea level and under normal atmosphere conditions with a running speed of 375 r.p.m. The Reavell compressor is rated to perform the above-mentioned maximum duties when running at the speed of 375 r.p.m., the brake horse-power required being 240.

As may be gathered from the drawing and photograph, the engine follows the makers' standard practice for a convertible gas or oil engine. It has five 13in. by 14in. cylinders and operates on the four-stroke cycle, with airless oil injection. The bed-plate is a single casting of box form in which the crank shaft bearings are carried. Its upper and lower faces are both machined and the under-part forms an oil sump which drains the spent oil from the fly-wheel end to the governor end of the bed-plate, from which it passes to an external oil tank and strainer. The lubricating equipment includes a National type cooler in the sump, with a by-pass and safety valve. The pump circuit works under a pressure of 5 lb. to 15 lb. per square inch. The crank case is a one-piece casting, which is secured to the bed-plate by studs, the upper face being machined and drilled to carry the cylinder jackets. It is furnished with large easily removable inspection doors, and faces are provided for the fuel pump and guide rod attachments, the fuel pump being cam operated through a bell crank lever. The cam shaft passes through the crank case and is supported on strong bearings which form part of the framing. Besides the inlet and exhaust cams there are cams for compressed air starting which control the supply of starting air to the cylinders. The crank shaft is drilled for forced lubrication, which is also carried up the connecting-rods to the piston pins, and is also supplied to the cam shaft bearings and other running parts. The liner is let into the top of the crank case and is held down by a joint at its top end by the cylinder cover. A deep-section cover is employed, which carries inlet, exhaust, and fuel valve casings. As the engine we are describing is to be sea water cooled, special care was taken in selecting the materials for the cylinder covers. The pistons carry four compression and two scraper rings, and are ground to finished size. Special valve gear features include isolating valves on the admission valves, which keep the gas and air quite separate from each other until they mix in the cylinder itself. Vokes air filters are fitted to the air inlet sections to prevent dust from entering the engine cylinders. All the exhaust connections are furnished with thermo-couples, which operate in conjunction with a multiple switch Cambridge pyrometer, thereby enabling the load on the engine to be balanced on the various cylinders by a comparison of the exhaust gas temperatures.

As dispatched from the works the engine was arranged for gas operation, but in the course of a few hours it can

INTERNAL COMBUSTION ENGINE AND COMPRESSOR

THE NATIONAL GAS ENGINE COMPANY, LTD. AND REAVELL AND CO., LTD., ENGINEERS



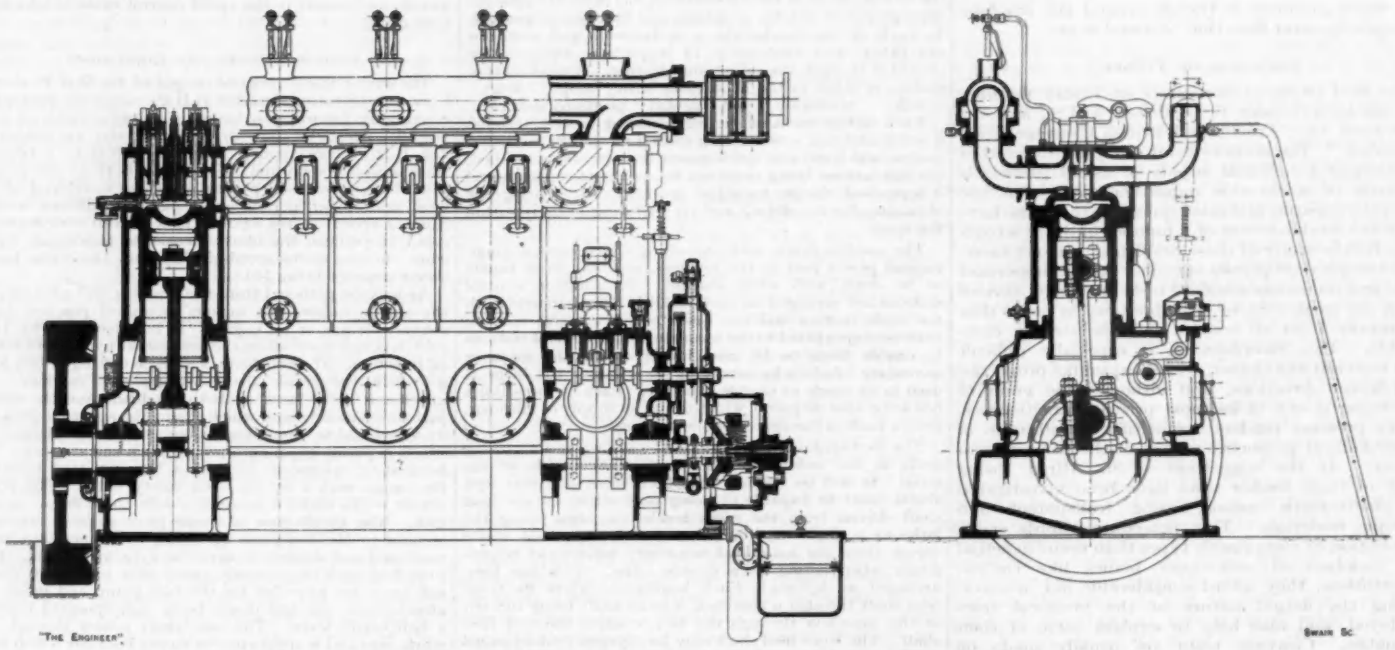
be converted for operation with heavy fuel oil. To make the change-over the gas and air governing valves have to be altered and the compression increased by fitting plates under the connecting-rod palms, while fuel pumps and spray nozzles instead of magnetos and sparking plugs have to be fitted. The complete conversion of the engine from gas to oil or *vice versâ* can be made, we understand, in less than ten hours.

THE BIBBY COUPLING.

The engine is direct connected to the compressor through a Bibby coupling with special characteristics designed to deal with the combined effect of two reciprocating machines. Since the engine has five cylinders and a substantial fly-wheel, it gives a cyclic speed irregularity of about 1/250, but the compressor has two cylinders, with cranks at 180 deg., and no fly-wheel, so that there is a reversed torque of about 50 per cent. of the mean forward torque twice every revolution. The coupling was therefore provided with a working resiliency of 4000 in.-lb. in both directions, and on test this was shown to be ample for the purpose of accommodating the variations and reversals of torque resistance. The coupling has considerable elastic flexibility to provide for accidental want of alignment which may occur on the plant, and the shafts may be as much as 1 deg. out of line and still operate smoothly and without danger to the drive.

THE GAS COMPRESSOR.

The gas compressor follows Messrs. Reavell's standard construction for vertical double-acting two-stage compressors and consists of a L.P. and H.P. cylinder on separate cranks side by side with a vertical intercooler between the two stages of compression. Lubricating oil is supplied to the main cylinders by mechanically operated lubricators—see engraving above—while a special forced lubrication pump driven from the crank shaft serves all the main bearings and the large and small ends of the connecting-rods. The suction and delivery valves are all of the low-lift multiple-ring pattern and are entirely automatic in their action. A special feature of the design is the provision of a large drain chamber at the bottom of the intercooler, which deals with the hydro-carbons in the natural gas which are liquefied during the first stage of compression and the subsequent cooling. The condensate from the low-pressure cylinder is drained to this point and a plunger pump driven from the end of the crank shaft returns the liquid through a perforated nozzle into the discharge pipe leading from the high-pressure cylinder, so that, if desired, the compressed gas can be re-saturated. The level of the liquid hydrocarbons is indicated by a sight glass arranged at the bottom of the intercooler drain chamber.



NATIONAL FIVE-CYLINDER CONVERTIBLE INTERNAL COMBUSTION ENGINE

TRIAL RESULTS.

The official trials of the assembled unit were carried out at the Ashton-under-Lyne works of the National Gas Engine Company, Ltd., and extended over two days. They were made in the presence of Mr. A. T. Beazley and Mr. P. F. Thurlow, of the Anglo-Ecuadorian Oilfields, Ltd., and Mr. J. R. Harkness, of the Anglo-Persian Oil Company, Ltd. The tests made demonstrated the ability of the set to perform the specified alternative duties of 1,500,000 cubic feet and 600,000 cubic feet per twenty-four hours at 130 lb. pressure, with the maximum and minimum speeds of 375 and 165 r.p.m. respectively. During the test a minimum speed of 158 r.p.m. was reached. The guaranteed output was actually attained at 355 r.p.m. and at 375 r.p.m. the output was 1100 cubic feet per minute, over 5½ per cent. above the guaranteed figure. When running at 158 r.p.m., the lowest speed, the output was 433 cubic feet per minute. In addition to these trials the set was also tested at a duty of 900,000 cubic feet per twenty-four hours at 130 lb. pressure, the speed in this instance being 210 r.p.m. The governing tests were very complete and included instantaneous release of pressure at full load. It was not possible, of course, to run the engine on a gas with as high a calorific value as the natural gas to be used in service, so town's gas of 450 B.Th.U. per cubic foot was used for the tests.

EXPERIENCE, says the *Iron and Coal Trades Review*, has established four specific advantages of Monel metal for utilitarian architectural use. In the first place it can be brazed, welded, or soldered in place, making it possible permanently to establish an absolutely watertight condition; secondly, it can be seamed if desired, using the double lock seam customarily employed with copper or other softer roofing metals; thirdly, it is stronger than mild steel, a quality that fits it for the insulated deck type of roofing and permits the use of wider spans which allows a reduction in the number of structural supports; fourthly, its durability makes possible the use of lighter gauge sheets than could be possible with less permanent materials. This reduces its relative weight and cost. Another more recent development of Monel metals for building purposes is found in expansion joints.

Early London River Steamers.

By GERALD AYLMER.

THE introduction of steam navigation on the Thames more or less coincided with the commencement of steam navigation on a practical and commercial basis in this country. It occurred as long ago as 1815, the year of the Battle of Waterloo. As railways out of London were not constructed for many years, it bestowed a great boon on the people of London, as the only way to reach Woolwich, Gravesend, or Sheerness was by the costly and tedious coach, while to reach Margate or Ramsgate meant either a longer infliction of this or a journey by the small, ill-found sailing packets, known as Margate hoys, which often took a couple of days or so, owing to an adverse or absence of wind.

It is proper to mention that a statement has been made that a Mr. Dawson in 1813 had a small steamer running between Gravesend and London. No definite details can be traced and the recognised authorities on the subject do not give the legend much credence.

The first steamer on the Thames of which there can be no question was the "Marjory." She was built in Scotland in 1814, and in the following year came down to London *viâ* the East Coast. On her arrival at the entrance to the river she created a great commotion among a squadron of warships anchored there, and was hailed by the nearest as to what she was. The reply, "That she was a steamer and from Scotland," no doubt caused an equal amount of astonishment amongst that portion of H.M. Navy. Her tonnage was 70, with a length of 63ft. by 19ft. beam, and she was fitted with side lever engines of 14 N.H.P. She was put on the London and Margate run with a stop at Woolwich. On her first voyage only ten passengers were brave enough to venture, but by the end of the summer she carried a large number on every trip. She must have been very staunchly built, as she continued to ply on the route until broken up in 1858.

The second steamer to appear on the Thames was built as the "Argyll" by J. and C. Wood, on the Clyde, and was renamed the "Thames" on reaching that river. She was of 74 tons, with a length of keel of 65ft., a beam of 14½ft., and was driven by engines of 15 N.H.P. Another authority gives her keel as 79ft. and beam 16ft. She was sent round to London, also in 1815, by way of the Irish Sea, a distance of 1500 miles. At times she encountered rough weather, which severely tried the ship and those on board. Her complement consisted of an ex-officer of the Navy, a Mr. Dodd, in command, a mate, engineer, stoker, four seamen, and a boy. She put in at Dublin, Wexford, and Portsmouth, where a courtmartial was adjourned to witness the novel sight. Eventually she rounded the Forelands, and concluded the venturesome voyage in a grand manner, romping up with the tide the 90 miles from Margate to Limehouse in nine hours. On her first trip to Margate she carried only eight passengers, one of whom was Sir Richard Phillips, who specially wrote to the Press to allay any alarm, with the result, as he solemnly stated in print, that within a voyage or two she carried no less than 350. If this were so, then a stevedore would appear to have been more necessary than a checktaker!

An introductory description of the "Thames" which appeared in *The Times* of July 8th, 1815, should not be missed. "She is rapid, spacious, and indeed a splendid vessel. Her cabins are large and are fitted up with all that elegance could suggest or that personal comfort could require. She presents a choice library, and backgammon, draught boards, and other amusements are provided. For the express purpose of combining delicacy with comfort, a stewardess tends on the fair sex." It is of interest to mention that from contemporary prints that a tall funnel did duty as a mast on which a large square sail was set when the wind was favourable. A long outside gallery on which the cabins opened gave the impression that she was larger than she actually was, and with her funnel in full blast, the funnel-sail set and drawing well, and the row of fourteen painted gun ports along her side, she must have indeed presented a formidable appearance.

During 1815 the London and Margate packet "Defiance" was put on service, and is said to have been the first steamer built on the Thames, but this has been disputed. The first steamer of which there is no doubt as to her London construction was the Margate packet "Regent." She was built in 1816 to the design of Isambard Brunel, and engined by Maudslay, the founder of the famous Lambeth firm of engineers. Her tonnage was stated to have been 112 net, with engines of 24 N.H.P. and her machinery was so light that it weighed only 6 tons. She was eventually burnt off Whitstable, but with no loss of life.

During 1816 another of Woods Clyde-built boats, the "Caledonia," was brought round to the Thames. She was 94ft. long by 15½ft. beam, with engines of 32 N.H.P. by Boulton and Watt. She only did a trip or so to Margate, as she was purchased by Mr. James Watt, fitted with new machinery, and despatched from Margate to Rotterdam, and on to Coblenz, being the first steamer on the Rhine. Also in 1816 the "Majestic" entered the river service, but evidently did not limit her activity to passenger traffic, as it is related that on August 28th, 1816, she towed the East Indiaman "Hope" from Deptford to Woolwich at 3 miles an hour against the wind, an achievement regarded at the time as remarkable.

In the following year it is on record that a Mr. Elias Evans, of Frindsbury, near Rochester, built the smart little packet "Son of Commerce," 85ft. long by 25ft. beam, with engines by Boulton and Watt, of 20 N.H.P. She plied for many years on the London, Rochester, and Margate route. There was also built in the same year the London to Margate packet "Favourite," which for many years proved her name with passengers. She was a large vessel of 160 net tons and had powerful engines of 40 N.H.P., and in consequence was the fastest packet on the river for some years.

Also in 1817 the "London" packet was built by Searle, of Westminster, and engined by Butterley. She was 85ft. long by 14ft. beam, of 70 tons register and was driven by engines of 20 N.H.P., constructed on the grasshopper principle with one cylinder. In the following year a craft of rather novel design was built for the Margate service by Brent, of Rotherhithe, and engined by Maudslay, Sons and Field. She was the "London Engineer," of 315 tons, 120ft. long by 24ft. beam, with a draught of 5ft. The engines, of 120 N.H.P., were of the bell crank pattern, and had two vertical cylinders, 36in. diameter by 30in. stroke, which were placed on either side of the vessel and drove a pair of *internal* paddle wheels. Steam at a pressure of 5 lb. was supplied by three single-furnaced copper boilers. As the main shaft was only just above the water level pumps were employed to pump air into the paddle casing, which was made air-tight so as to keep the water level low, but the arrangement was not found to work satisfactorily. In 1818 a very well-known Margate packet, the "Victory," was built at Rotherhithe, of 160 tons, with engines of 40 N.H.P., and was well patronised during her twenty-four years on the route. Special attention was paid to her passenger accommodation, and the description and coloured engraving of it in a handbill still existant would scarcely do justice to the "Berengaria."

When once the certainty and safety of the river steam packets was established, it was surprising the immense popularity they gained, not only as a means of transport pure and simple, but also for excursion purposes. It is related on good authority that from 1820 to 1824 the number of passengers exceeded a million each year, and in one particular year exceeded a million and a quarter. The number of the packets increased with great rapidity, but the question of space prevents us detailing them in full, neither would the information be of great interest. Therefore, mention will only be made of those which mark a step in progress or which possess some interesting constructional feature.

Of the packets built before 1820, mention must be made of the "Rapid," built specially for the Thames service at Greenock. She was powerfully engined for her size, and had a reputation for speed, and there is a record of her having run well into the 'thirties. The "Duke of Sussex" was also a very fine packet of her day, and showed considerably increased dimensions, being 143ft. long by 16ft. beam, with engines of 80 N.H.P., and she continued on the route until about 1850.

During 1824 occurred an event of great importance to the steamship service of London. A Mr. Brocklebank for some years had run the Margate packet "Eagle," and, encouraged by its success, he interested others to further the venture, and thus at a meeting held on June 11th, 1824, at a house on Custom House Quay was formed the General Steam Navigation Company, which is in a better state of health after having reached its centenary than ever it has been. It is interesting to note that the packets which were built for them and not purchased have ever since been named after birds, and that to-day they have the very fine "Eagles" running on their river service, a naming custom no doubt due to the name of their early "Eagle" in 1824. A print of her exists, and shows her to have been an imposing vessel with the usual tall funnel, not carrying any sail, but setting a large square sail on both masts. She was built at Deptford, and purchased by Mr. Brocklebank in 1820. She had engines of 40 N.H.P. by Boulton and Watt, and she ran well into the 'forties.

The new company at first concentrated on the London to Gravesend, Margate, and Ramsgate service. To join the "Eagle," they purchased the "Royal Sovereign" and the "City of London," vessels of about 100 net tons, 130ft. long by 19ft. beam, with engines of about 30 N.H.P. The "City of London" must have been of sturdy construction, as we have a record that in about 1844 she was transferred to their Dover and Calais service, and remained on that route until 1850. The "Magnet" was another of the company's well-known river packets. Built at Limehouse in 1826, she was of 166 net tons, with a length of 139ft. by 21ft. beam, and driven by engines in the region of 150 N.H.P.

In the years following, when the General Steam Navigation opened up their overseas trade, they employed their vessels on that service and on that of the London river during the summer, and as none were constructed solely for the river packet service, they are not dealt with in this article, but it must not be concluded that we have overlooked many of their earlier vessels. It was not until many years later, when all their fleet were deep-sea screw boats, that the company had built for them shallow-draught paddle vessels purely for river work.

During the late 'twenties, a steam packet company was formed, with headquarters at Margate, entitled the Margate and London Steam Packet Company. They were known as the Royal Line, as they opened the service in 1830 with the "Royal George," built by Fletcher and Fearnal, of 240 tons and 140 N.H.P., closely followed by the "Royal Adelaide," of 230 tons and 160 N.H.P. Snooks, of Limehouse, built the two latter, but all were engined by J. Seaward and Co. The company, we believe, was purchased by the General Steam Navigation in 1835. About this time the Gravesend Steam Packet Company ran vessels from London and Gravesend to Sheerness, Margate, and Ramsgate. The best of their fleet was the "Greenwich," built at Poplar in 1835, of 150 tons, with engines of 50 N.H.P. Others of the fleet were the "Royal Tar," "Gipsey," "Water Lily," and "Fly," which secured for several years their share of the increasing river traffic.

During 1834 a well-known and successful line of river packets was established, the Woolwich Steam Packet Company, which ran an efficient service between Charing Cross and Strother's Wharf, High-street, Woolwich, leaving Woolwich at 9 a.m. and 2 p.m., and returning from Charing Cross at 11 a.m. and 4 p.m., with calls at Greenwich and Queenhithe. The fares were very low, that for the main cabin being 1s. and the second cabin 9d., with a Sunday all-round fare of 1s. The first chairman was a Mr. Jackson, an energetic and prominent Woolwich citizen, who can be said to have been the founder of Clacton-on-Sea, to further popularise which he established a London and Clacton Steam Packet Company. The Woolwich company commenced their service with the very smart little packets "Sylph," "Fairy," and "Naiad," and by 1837 had added two more, by which they were able to increase their services to four or six journeys per day in winter and seven or nine in summer.

The Woolwich company met with bitter antagonism from the river watermen, who claimed that their very ancient privileges and rights had been ruthlessly trampled on. At first they vented their spleen by such petty tricks as blocking the way of the packets by barges, but the Waterman's Guild, which was very wealthy and powerful, decided to carry the war into the enemy's camp, and formed the Waterman's Steam Packet Company, consisting of twelve fast packets. The engines for eleven of these were constructed by John Penn and Co., of Greenwich, and were of their famous oscillating cylinder design. The cylinders were 24in. diameter with a 27in. stroke, and steam at 8 lb. was supplied by one boiler, which, it is interesting to note, was of the water-tube pattern. A splendid miniature model of one of these engines is in South Kensington Science Museum, and is said to have been made by one of Penn's workmen. A fierce competition at once arose between the rival concerns. The packets were purposely timed to start together, and racing was indulged in without any restraint. The pace became too hot to last, the Waterman's company could not stand the strain, and it was eventually bought up by the older concern. Even when the railways reached Woolwich, that of the G.E.R. to North Woolwich in 1847 and the S.E.R. in 1849, the popularity of the Woolwich packets did not lessen to any extent. It is recorded that on the occasion of the Crimean War peace celebrations in London during May, 1855, that the packets were bringing crowds of people home up to 4 a.m. next morning. The Woolwich Steam Packet Company in 1875 was absorbed into a combine of several river companies.

During the 'thirties two companies came out, between which there was keen competition. One was the Diamond Line, who adopted for their names precious stones; the other was the Star Line, whose packets were all named after planets. Probably the best known of the Diamond fleet was the "Ruby," built in 1836 by Wallis, of Blackwall, of 243 gross tons, with a length of 155ft., a beam of 19ft., and a depth of 10½ft. Instead of using frames, she was built up of three layers of diagonal planking nailed together with felt in between, which construction, although strong and durable, was known as "lath and plaster." Her engines were of the usual side lever pattern by Seaward, with two cylinders 40in. diameter, with a stroke of 41in., rated at 110 N.H.P., and supplied with steam at 5 lb. pressure. Her speed was 11.5 knots, half a knot in excess of any other river steamer. A working model of her engines is in the South Kensington Science Museum. She remained the fastest packet on the river until the Star brought out their "Meteor" in 1844, built by Miller and Ravenhill, which, although not much larger, was considerably faster than the "Ruby."

By about 1835 the popularity of the lower river had increased to such an extent as to be hardly believeable to-day. The packets filled up to their utmost limits, and raced madly one against another down the river. The companies openly boasted of the cleverness of their commanders in cutting in on rivals and of cutting off corners. To this period belong the well-known lines—

> "We ain't a-racing where the craft is thickest;
> We're only trying which can go the quickest."

Owing to the lesser number of docks and of the expense of docking, cargo ships unloaded in the stream much more than they do at present. Between the lines of these moored ships the packets raced, jockeying one another to be first at some intermediate pier to get the passengers for Gravesend and Margate. The early Victorian days are supposed to have been staid and cautious, but such conditions would not be tolerated for one moment at the present-day, either by the river authorities or by the passengers. That an appalling catastrophe never occurred between these reckless excursion packets is nothing less than a miracle. The very numerous complaints made by other users of the river were thoroughly justified, and attempts to remedy the state of affairs were made by the City Corporation, but warnings were merely laughed at. The overcrowding became such a scandal that even the stately *Times* of those days protested. On April 10th, 1838, it remarked that it would be as well if some measures were adopted to prevent the dangerous overcrowding during Easter and Whitsun, as "during those holidays in the previous year the small packets carried between 500 and 600, and the larger anything up to 1000 or 1500, the passengers being packed as closely as the slaves in a slave ship."

When the Blackwall Railway Company completed their line from the Minories to Blackwall, the terminus station being on the edge of the river at Brunswick Wharf, they ran, by means of a subsidiary company, a line of packets to Margate and Ramsgate. Their "Prince of Wales" was a fine iron vessel, built at Deptford in 1841, with a length of 180ft. The inverted beam engines, by Miller and Ravenhill, and rated at 136 N.H.P., gave her a good turn of speed. The "Brunswick" soon followed, and although a slightly smaller vessel with machinery not so powerful, was finely designed and was faster, even claiming to be capable of 14 knots.

Previous to these two, the company had built for them by Ditchling and Mare in 1840 a vessel which, as regards her method of propulsion, was rather a freak. She was named the "Propeller," and was fitted with a single rectangular board on either side, which dipped into the water, and was forced astern a certain distance by an iron arm operated by the engines. It was said to give her a speed of 10 knots, and create no wash. She ran between Blackwall and Gravesend for several years, but whether she retained this peculiar arrangement we cannot say.

About 1835 a company came into existence, termed the London and Herne Bay Steam Packet Company, whose vessels ran between London, Herne Bay, and Margate. Their two best were the "City of Canterbury," built at Poplar, of 260 gross tons, with engines of 120 N.H.P., and the "Rover," and they proved two of the fastest packets on the river. The "City of Boulogne" was a large and fast river steamer, built at Barking in 1838. She was of 270 gross tons, 135ft. long by 20ft. beam, and for those days had powerful engines—120 N.H.P. We believe she was eventually purchased to run on the service from Dover to Boulogne.

The down-river passenger service to and from London and certain towns in Kent and Essex, can conveniently be divided into three phases. The first from the introduction of steam navigation on the river to about 1840, with which we have dealt in this article, when the traffic steadily increased each year and when new companies sprang up one after another. The second phase was from 1840 to 1890, when the traffic began to dwindle, owing at first to the increasing competition of the railways, but

later to the terrible disaster to the "Princess Alice" in 1878. This ill-fated vessel was built by Cairds in 1865 for a Scottish company, but was subsequently sold to the London Steamboat Company, which had been formed about 1835. She was 219ft. long by 20ft. beam, and driven by engines of 140 N.H.P. On September 3rd, 1878, she was returning to London crowded with excursionists, and had just come within sight of Woolwich at about 8 p.m. when she was rammed on the side by the "Bywell Castle," and sank with a loss of 590 souls. This struck a stunning blow at the already declining London river passenger service, from which it took years to recover. People shunned the river packets and acquired the railway habit, which is one not easily got rid of. But gradually the sad event became blurred by time, and confidence began to grow again, and amongst the packets which did so much to pave the way for the great river boom of the third phase were the splendidly conducted vessels of the General Steam Navigation Company, who retained a summer service practically all through, the regularity of the little "Glen Rosa" and the size and comfort of the speedy "Lord of the Isles."

The third phase was from 1890 to war time, during which a magnificent excursion service was provided by the General Steam Navigation Company, the Belle Line, and the New Palace Steamboat Company, who, between them, possessed a fleet that for speed, comfort, and absence of mishaps, could not be matched by any other of similar purpose the world over. Among the best known were the half-dozen speedy and elegant "Belles," the turbine-driven "Kingfisher," of the General Steam Navigation Company, the stately "La Marguerite" and the popular "Royal Sovereign" and "Koh-i-noor" of the New Palace Company.

To indicate the great strides that have been made in the size, power, and speed of the London river packets, we tabulate below particulars of three typical vessels built at various times, namely, the "Thames" of 1815, the second steamship on the river, the "Ruby" of the 'thirties, and the "Koh-i-noor," which, although by no means the largest, was a fair example of the steamers which ran up to the outbreak of the war :—

	"Thames."	"Ruby."	"Koh-i-noor."
Built	1814	1836	1892
Tons	70 net	243 gross	844 gross
Length	63	155	300
Beam	19	19	32
Horse-power	14 N.H.P.	110 N.H.P.	3500 I.H.P.
Speed	6–7	11·7	19·5
Lbs. pressure	3	5	120
Cylinders	—	40×41	45, 80×66
Engines	Side lever	Side lever	Compound diag.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

"OVER ONE HUNDRED PER CENT. EFFICIENCY."

SIR,—Although the season when incredible things may be discussed in the Press is drawing to a close, will you permit me to reply to the letter of Mr. A. H. Waring in your issue of September 2nd. The writer endeavours to support the claims made by Messrs. Brown, Boveri for a possible boiler efficiency of over 100 per cent., but he would have been on much safer ground had he confined himself to justifying his belief by the classic "*credo quia impossibile est.*" His arithmetical demonstration is quite inacceptable. Taking his own figures, we have air entering a furnace at 2 atmospheres pressure and at a temperature of 95·5 deg. Cent. The temperature and pressure are then raised by the explosion of the fuel, and heat is then abstracted by the boiler surface until the temperature has fallen to 85·5 deg. Cent.

Mr. Waring then assumes that the pressure will now be 3·33 atmospheres, whereas, unless the laws of Nature in Switzerland are different from those elsewhere, the pressure must be below 2 atmospheres and, therefore, inadequate to drive the compressing machinery.

Your leading article on the subject should have been sufficient to convince anyone that any scheme for obtaining extra boiler efficiency by discharging the gases from the turbine at a temperature below that of the atmosphere involves a fallacy. However, perhaps the following demonstration may be acceptable.

A plant will be considered, working on the lines proposed by Messrs. Brown, Boveri, and discussed by Mr. Waring. To give it every chance, both compressor and turbine will be assumed to be perfect. Furthermore, for the sake of simplicity, the weight of flue gas produced will be considered to be equal to that of the air supplied, and both will be regarded as having the properties of perfect gases.

Let the initial conditions of the air be P_1, T_1, V_1 and the total heat per pound be $H_1 = E_1 + P_1 V_1$.

First Operation.—Compress the air adiabatically to any pressure and deliver it. The temperature will rise to T_2 and the total heat will become :

$$H_2 = E_1 + P_1 V_1 + C_p (T_2 - T_1).$$

Second Operation.—Add any quantity of heat at constant volume by the explosion of the fuel. The temperature will rise to T_3 and the total heat will become :

$$H_3 = E_1 + P_1 V_1 + C_p (T_2 - T_1) + C_v (T_3 - T_2).$$

Third Operation.—Extract any quantity of heat at constant volume by the boiler. The temperature will fall to T_4 and the total heat will become :

$$H_4 = E_1 + P_1 V_1 + C_p (T_2 - T_1) + C_v (T_3 - T_2) - C_v (T_3 - T_4).$$

Fourth Operation.—Let the gas do any amount of work by adiabatic expansion in the turbine. The temperature will fall to T_5 and the total heat will become :

$$H_5 = E_1 + P_1 V_1 + C_p (T_2 - T_1) + C_v (T_3 - T_2) - C_v (T_3 - T_4) - C_p (T_4 - T_5).$$

Fifth Operation.—Let the exhaust gases take in heat from the atmosphere at constant pressure until they are restored to their initial state, thus completing the cycle. The total heat must then be the same as at the beginning. The heat entering will be $C_p (T_1 - T_5)$, so that :

$$E_1 + P_1 V_1 + C_p (T_2 - T_1) + C_v (T_3 - T_2) - C_v (T_3 - T_4) - C_p (T_4 - T_5) + C_p (T_1 - T_5) = E_1 + P_1 V_1.$$

Cancelling out the terms of this equation we have :

$$T_2 = T_4,$$

which means that, if the plant is to work, the temperature at which the gases are delivered to the turbine cannot be less than that at which they entered the furnace, hence, the boiler cannot extract more heat than was supplied by the fuel, no matter what the final exhaust temperature may be reduced to.

Furthermore, since for the work done by the turbine to equal that required for the compressor, both machines must work through an equal range of temperature, and since $T_2 = T_4$, it follows that $T_3 = T_1$; hence, if the turbine is to drive the compressor, it cannot exhaust below the initial temperature of the air.

This proof appears to me to be an entirely general one, and to dispose definitely of the claims which you, yourself, showed to be impossible of achievement.

September 3rd. M.I. MECH. E.

LEICESTER AND SWANNINGTON RAILWAY.

SIR,—That the Swannington winding engine was made by the Horseley Company, and possibly was designed by Isaac Dodds, is shown by the following extract from the minutes of a meeting of the Leicester and Swannington Railway Company, held on April 2nd, 1833 :

"Tenders for furnishing a stationary engine for the inclined plane at Swannington were opened and read from the following persons, viz.:

(1) Thomas Banks and Co., Manchester.
(2) Horseley Coal and Iron Company.
(3) W. Baldwin and Co.,

and a letter of inquiry from Mr. Isaac Dodds, AND it was resolved that the tender of the Horseley Company be accepted and an order given."

Watford, August 14th. G. ROYDE SMITH.

HOURS OF LABOUR.

SIR,—If I may be allowed to reply to your comment on my letter of last week, I should like to submit that the undoubted fact that a man could produce more of a commodity than he could himself consume is irrelevant.

Your own analysis correctly showed that no manipulation of hours of labour could be expected to provide a permanent solution, which is to be expected since the flaw is in the financial and not the productive system.

The fact that at the moment we have so-called over-production coexisting with real want of the same article *is* relevant and should be unthinkable in any developed civilisation. This is, however, a necessary feature of our present scheme of loan accountancy and follows from the policy of making credits available for the manufacture of goods, but providing none to take them off the counter.

London, S.W.1, September 5th. B. WOOD.

The Model Engineer Exhibition.

WE wonder if the personality of those who are responsible for the production of a technical exhibition is impressed upon the exhibitors, for, if that is a fact, Mr. Percival Marshall has been eminently successful in his latest Model Engineer Exhibition, which closes to-morrow at the Royal Horticultural Hall, Westminster. The Exhibition is most varied, as one would expect in the circumstances ; but while some familiar features are absent on this occasion, there are others to take their place. We were, for instance, sorry to miss the display of the Air Force Training Centre, which has heretofore provided an incentive to young men to accurate workmanship by showing what can be done in the way of fitting with hand tools. Those exhibits of the Air Force have given examples of which even Whitworth would have been proud. On the other hand, there has been a development of the Exhibition towards marine engineering, which is rather noteworthy in the present stage of the shipping business. There is a predominance, among the models, of boats, both sailing and power-driven, and it is noticeable that the former class is much more orthodox than the latter. The sailing boat has, of course, been in existence far longer than the steamer, but even it, although it appears to have settled down to a somewhat standard form, is subject to change—witness the recent craze for the Bermuda rig. With the power-driven boat, as represented by the model maker, however, the characteristics are different. The hulls may be all "very-much-of-a-muchness," but the arrangement of the machinery is very varied. And it is really remarkable what these little vessels of about 30in. long will do, speeds of 30 miles per hour being quite common. It is also noticeable that the steam-driven boats are faster than those with internal combustion engines.

A very pleasing feature of the Exhibition, especially at the stands of the clubs showing the efforts of their members, is the enthusiasm of the attendants. They are all club members and delight to talk on the technical side of their hobby. And model-making is a technical affair which must help largely to foster the mechanical genius of our young people. Many of them have few facilities at their command, and the devices which they must consequently use are an excellent training for the mind and the hand, while it is possible that their production may result in a true invention. There are, of course, other model-makers who possess workshops with elaborate equipment, and who turn out machines of the most perfect workmanship, but the enthusiasm of both is equal.

Among the latter category there must, of course, be included Dr. J. Bradbury Winter, to whose model, in silver, of the "Rocket," on a scale of ½in. to 1ft., we have already referred. Dr. Winter has brought a collection of tools which he devised and used in its construction, and is tireless in explanation of them. He also has an electric clock on the principle invented by William Congreve about a hundred years ago, in which a metal ball rolling down an inclined zig-zag course sets the time by making electrical contacts at the ends of its travel, and the extraordinary perpetual calendar of which we made mention last week. Dr. Winter, by the way, tells us that he has given up his home in Switzerland, where he made the "Rocket," and is now living in this country. It may safely be said that the workmanship of his models has never been surpassed and rarely equalled.

Among the exhibitors of model-makers' tools there are several old friends, but many of them are showing machines of new design. Drummond Bros., of Guildford, have a 3½in. lathe that is fitted with a new tool rest, which has a vertical adjustment and appears to be very convenient. The mandrel is now fitted with adjustable coned bearings and a simple catch for locking the back gear. E. Gray and Son, Ltd., of 18, Clerkenwell-road, London, E.C.1, show a great variety of hand tools, as also do S. Tyzac and Son, Ltd., of 341, Old-street, Shoreditch, London, E.C.1, and Buck and Ryan, of 310, Euston-road, N.W.1. W. T. Henley's Telegraph Works Company, Ltd., 11, Holborn-viaduct, London, E.C.1, is demonstrating an electric soldering iron, which appears, at first sight, to be rather on the light side, but we have satisfied ourselves that it is capable of quite heavy work. The Soldo Company, of Sicilian House, Southampton-row, London, W.C.1, is demonstrating the soldering flux, which will effectively tin any metal except aluminium, that we have referred to on past occasions. The Exe Engineering Company, of Exeter, has a 3½in. gap bed screw-cutting lathe and another of 2½in. centres.

We will not attempt to catalogue the many exhibits of commercially made models, as their general character is familiar to our readers. Neither will we enlarge upon the models sent in in competition, except to say that they are as diverse and excellent as usual.

SIXTY YEARS AGO.

CANTERBURY Cathedral—not for the first time in its long and tumultous history—suffered severe damage by fire in the summer of 1872. Its roof, composed of wood with a lead covering, was partially destroyed. The cause of the outbreak was traced without a shadow of doubt to the braziers of plumbers employed on repairing the lead covering. The mishap aroused much public attention, for it was realised that many other notable buildings in the country were exposed to the same risk from the same cause. *The Times* mourned the catastrophe at two columns' length and published much correspondence from its readers on the subject. In our issue of September 6th, 1872, we commented very briefly on the mishap and laid it down as a principle firmly to be observed that plumbers should never be allowed to kindle a fire on the roof of a lead-covered building. Their solder should be melted and their soldering irons heated at a fire on the ground and be hoisted up to them by means of a pulley and cord. In the following week's issue we returned to the subject in a full-length leading article, for in the meantime much which we characterised as foolish had been written upon it. One writer showed a close and practical knowledge concerning lead roofs throughout the ages. He took us back to Roman times and showed that custom had scarcely changed as regarded either the laying or the repairing of lead roofs. Cast lead sheets, he said, were still preferred to rolled sheets because architects believed them to be sounder and because many plumbers possessed casting tables and found it advantageous to foster the delusion. Cast lead, it was argued, was much more liable to develop cracks under thermal expansion and contraction than was rolled lead. Cracks were, however, bound to appear in both forms sooner or later. Even when the lead was laid, as all good plumbers laid it, without soldering it or attaching it anywhere to the wooden backing except at the top ends of the sheets its cracking would only be a question of time. When even only moderately heated lead, it was stated, became so soft that its expansion was unable to overcome the friction created by its weight resting against the roof boarding. As a consequence, instead of expanding uniformly and remaining flat, it swelled irregularly and the continued bending at the swellings led to the development of cracks. When cracks appeared the best and most economical method of repairing them was by soldering. That method could, however, only be applied up to a certain limit, for every crack repaired by soldering tended to produce new cracks. In time there was nothing for it but to relay the roof with new lead. We would have nothing to do with the "autogenic soldering" process which Dr. David Price had written about in *The Times*, a process making use of an ignited jet of hydrogen and a lead rod. It was, we said, impracticable of application on a steep-pitched roof, and in any event the "autogenic patch" would by its contraction simply tear out a fresh crack in its neighbourhood. Altogether it was quite a pretty problem. Our solution of it was, however, quite simple. We proposed that lead roof coverings with their unsightly form and unattractive colouring should be abolished altogether and that more modern materials should be used instead.

Railway and Road Matters.

THE Royal Commission on Transport in Canada, including Lord Ashfield, is now sitting in Ottawa considering the draft report prepared before the adjournment in June.

DURING the week ended March 12th, 1932, the total number of staff employed by British railways was 597,971, compared with 615,592 during the week ended March 7th, 1931, a decrease of 17,621, or 2·86 per cent. The total amount of salaries and wages paid by the railway companies for the year 1931 was £105,835,000, compared with £114,536,000 in 1930.

A NEW kind of Sunday afternoon excursion will be given a trial by the L.N.E.R. on September 11th, when two trains will be run along the North Yorkshire and Cleveland branch lines and by the coast route, with the special object of showing passengers the beauty of the moorland and coastal scenery. The carriages will be equipped with large plate-glass windows to enable all passengers to obtain good views of the country.

THE electrically operated lines of the London, Midland and Scottish Railway between Camden and Watford are being equipped with automatic signalling. Herein, on June 17th, we recorded the opening of the signals between Willesden and Hatch End, and now we have to report the inauguration, on Sunday last, the 4th inst., of those between Willesden and Kilburn. The installation is to allow for a more intensive operation of electric trains between Euston, Broad-street and Watford.

THE U.K. Railway Returns for 1931 show that the total length of line open for traffic on December 31st was 20,408 miles, *i.e.*, route miles, an increase over 1930 of 4 miles. Expressed as single track, *i.e.*, track miles, there were 37,199 miles of running line, an increase of 27 miles; and 15,638 miles of sidings, an increase of 36 miles. There are 119 miles of new line and 398 miles of widening sanctioned, but not opened for traffic. The mileage of track renewed in 1931 was 1359½, as against 1361 in 1930.

A LETTER in *The Times* of September 2nd, from a firm of solicitors, on the subject of road accidents, was based on the statement of a tram driver that his occupation did not allow him to go about his work in doubt; in other words, as the letter said, "any extraneous matter on the mind detracts from that concentration on the road which is an absolute necessity under modern conditions." Of recent years, it has always been the practice of the Inspecting Officers, when holding inquiries into railway accidents, where men have made some unusual mistake, to ask the man concerned, "Had you anything on your mind; any domestic or financial trouble?"

IN an excellent leader on "Safety on the Roads" in *The Times* of August 29th, there was a half implied suggestion that the occupation of a shunter is an exceptionally dangerous one. The words were in a sentence which read "Even the railways, which last year killed—shunters included—only about one-twentieth of the number killed on the roads . . ." Reference to the accident annual returns shows that only thirteen shunters were killed last year, which cannot be admitted as a high figure, and it was not as many as permanent way men, or goods guards, and was the same as drivers. Actually, judged by the proportion of fatalities to men employed the occupation of signal fitter is more risky, as one shunter in every 1326 met with a fatal accident, but among signal fitters it was 1 in 930.

THE mention herein on August 26th of the viaduct near Wichnor Junction, L.M.S. Railway, having been rebuilt in wrought iron in 1879 recalls an incident that occurred whilst that work was in progress. All trains over the bridge were worked over a single line, so as to give the engineer possession of the other line for his work and the necessary signals and a pilotman were provided. One night, whilst all the traffic was running on the down side, the up Tamworth mail approached, ran by all the signals and at high speed through the temporary connection from the up to the down line. The incident caused some alarm to the operating and engineering officers of the Midland Railway, who decided to erect, under future similar conditions, a bracket signal post with three red lights placed to form a triangle.

THE winter train service comes into operation on Monday next, September 12th. The outstanding alteration is that the "Cheltenham Flyer" of the Great Western is to be further accelerated so as to make the run from Swindon to London in 65 instead of 67 minutes. That will involve an overall speed of 71·35 m.p.h. The Scottish services to and from Euston, St. Pancras and King's Cross will be much better than last winter. The 8 a.m. from Newcastle will make the journey in 21 minutes' less time, and the 5.30 p.m. return train will gain 13 minutes. One of the changes in the provincial train services is that the "club train" from Manchester, Victoria, to Blackpool Central, which, for a good fifty years, has run non-stop to Lytham in 67 minutes, is to cover that stretch in the even hour. The similarly old-established train that leaves at 5 p.m. for Southport is to have 42 instead of 47 minutes to reach St. Luke's station.

IT was a singular coincidence that just as our issue of September 2nd, wherein was an article on "Safety on the Tubes," was going to press an unprecedented hold-up of the traffic was being experienced at Camden Town, London Electric Railways, owing to a signal persistently exhibiting red when it should have indicated green. That led to another operating rule, other than the one relating to train stops, having to be put in force. It provides that when a signal indicates "Danger," the motorman, after standing for one minute, may, if he sees that the line ahead is clear, proceed cautiously. If, however, as undoubtedly was the case at Camden Town, the line ahead could not be seen owing to a curvature of the line, the conductor of the train must proceed on foot in advance and the motorman follow with the train at a walking pace not nearer than a car's length to the conductor and in response to his hand signal. As the lines for four directions join at Camden Town the train service at that point is the densest on the system, and it will be appreciated how the compulsory obedience to the rule in question caused chaos. It led to delay but secured safety.

Notes and Memoranda.

THE new suspension bridge with a span of 1000ft. at Cavaillon, on the Durance River, is said to be the largest in France. It was formally opened on Wednesday last by Monsieur Daladier, Minister of Public Works.

THE General Electric Company of America is developing an electric lamp employing a silent discharge through sodium vapour. Although the colour of the light produced is said not to be useful for domestic lighting, the efficiency claimed is 34 lumens per watt.

THE amount of steel required for the penstocks of the Hoover Dam hydro-electric project on the Colorado River is over 55,000 tons. The pipes, which are being made by Babcock and Wilcox, vary in diameter from 8ft. 6in. to 30ft. and some of them will have a wall thickness of 2⅞in. The pipes are to be transported to the site in sections, which may weigh as much as 150 tons each and are to be fusion welded together.

"CANNED oxygen" is the name given in Germany to an invention governing the chemical fixation of oxygen in such a way that the gas may be carried about in the form of briquettes, and yet be immediately available for breathing purposes. The oxygen, it is stated, can be stored and moved about to any extent without risk of explosion or fire. After an initial warming—set in action by a blow—the briquettes give off for hours without pressure an even exhalation of oxygen.

DURING the first half of the current year shipping aggregating 14,042,000 net tons passed through the Suez Canal, or 1,650,000 tons less than in the first half of 1931, and 2,812,000 tons less than in the first half of 1929, the record year. The British flag showed a loss of 930,000 tons, the German flag one of 405,000 tons, the Dutch flag 232,000 tons, and the French flag 56,000 tons. The following four flags showed gains:—Italian, 54,000 tons; Danish, 43,000 tons; Russian, 35,000 tons; and Japanese, 33,000 tons.

IN the August number of the *Scientific American*, there is a short account of the new electrostatic generator which is being built by R. J. van de Graaff at the Massachusetts Institute of Technology. The generator is a large-scale elaboration of the Wimshurst type of machine, consuming considerable power in its operation. The discs of the Wimshurst machine are replaced by silk belts, and the separation of charges made regenerative. The charges are collected on enormous metal spheres, sufficiently large to hold an experimenter and apparatus, and capable of being charged to 10–15 million volts without flashover.

FROM the vast deposits of tar sands in Northern Alberta (covering 6000 or more square miles of territory) it has been possible by a method developed by the Research Council of Alberta to extract bitumen. Chemists in the National Research Laboratories, working under the direction of Dr. G. S. Whitby, Director of the Division of Chemistry and one of the world's leading authorities on rubber, have continued the study of bitumen and a process whereby it may be made suitable for use in the manufacture of rubber has been developed, and the product is now being tried out on a large scale in one of the Canadian rubber factories.

A NEW, odourless, permanent treatment for coal and coke, known as Coalkote, has been developed by the Sun Oil Company, 1608, Walnut-street, Philadelphia. It is a heavy concentrate which, says the *Iron and Coal Trades Review*, emulsifies with 15 to 20 parts of water, and is applied with standard spraying equipment. Drying quickly on the coal it forms a black lacquer-like, permanent, waterproof coating which improves its appearance and renders it dustless. The treatment is non-corrosive to metals, textiles and leather, and is said to improve the burning qualities of coal. The cost of treating coal and coke ranges from 3 to 8 cents per ton.

A NEW type of fuel made from dross coal is being turned out at the rate of 15 tons per day by a Congella factory in Natal. The fuel as at present made comprises dross coal with molasses used as a binder, the mixture going from a moulding machine into a carbonising oven of patented design and construction, from which, according to the *South African Engineer*, the material emerges practically free of all the impurities contained in coal. It is sold in the form of cakes, and produces an intense heat, no sparks, and a third less smoke than ordinary coal, while it burns to a fine ash, free from cinders. It is being tested locally by several steam lorry owners, including the Municipality.

ACCORDING to the *Journal* of the National Smoke Abatement Society, it is not possible to recommend any preservative solution for protecting stonework against atmospheric corrosion, except for temporary and special circumstances. The washing with water of buildings in which the stone is still in comparatively good condition is cheap and effective. The cheapest way of cleaning is by fire hose from the ground, and where the stone can be scrubbed by hand, as was recently done by H.M. Office of Works at Buckingham Palace, it is probable that washing every five years or so will prove adequate to maintain a good appearance in London. The steam brush is stated to be useful, but alkalies are harmful.

IN the final report of the Adhesive Research Committee of the Department of Scientific and Industrial Research, which has just been issued by H.M. Stationery Office, it is stated that a good lubricant should attach itself firmly to the solid surface, but should have only a feeble hold upon successive layers of molecules. It should resemble graphite rather than diamond. An adhesive, on the other hand, whilst holding firmly to the solid surface, must likewise hold firmly to further layers of molecules, thus producing static friction. It seems most probable that in such cases the first layer of oriented molecules is the starting point for chains of oriented molecules extending from it deep into the bulk of the liquid or solid adhesive. The effect of this will not only be high static friction, but also the simulation of a great range of molecular attraction. This will also be closely related to the magnitude of the pull normal to the surface required to break a joint.

Miscellanea.

AN Ohio firm of piston-ring manufacturers, the Wel-Ever Company, has established a factory in Windsor, Ontario.

THE Italian liner "Rex" has completed her first sea trial at an average speed of 28 knots for a distance of 600 sea miles.

A GERMAN firm has put on the market a form of filter cloth made of soft spongy rubber. It is said to be especially useful in the filtration of semi-colloidal sludges.

ACCORDING to a Cairo message, the Suez Canal Company is creating a museum which will contain all available objects and documents connected with the history of the canal.

THE Russian "plan" for the production of heavy metals has suffered a reverse during the past six months, the output being below that forecasted; but the amount of shipbuilding completed was 5 per cent. above that expected.

ACCORDING to a note in the *Engineering News-Contract* the use of treated timber, in the place of reinforced concrete in the reconstruction of the approaches to the Ballard Bridge in Seattle, will reduce the cost from £1,800,000 dollars to 350,000 dollars.

PLANS for the construction of a network of trolley car lines for the main thoroughfares of Nanking are under consideration by the National Reconstruction Commission of China. It is learnt that preparations are far advanced and the project practically decided upon.

ACCORDING to estimates of the German Acetylene Association, about 70,000 tons of calcium carbide were employed in Germany last year for the production of acetylene for autogenous metal welding. The figure compares with the 90,000 tons of 1930 and the 105,000 tons in 1929.

THE triennial review of irrigation in India during 1927–30, which has just been published, shows the average area irrigated in British India by Government works of all classes during the triennium to be about 30 million acres, as compared with 27·8 million acres, the average of the previous triennium.

A FLOW of dry gas, estimated at 10,000,000 cubic feet per day, was encountered in the Athadome well, which is being drilled on the north shore of the Athabaska River, Northern Aberta. The flow was encountered at 1800ft. The Athabaska tar sands are expected to be reached within 500ft.

THE two blockships sunk at the western entrance of Dover Harbour to prevent torpedo attacks during the war are being raised after eighteen years. The "Lavonia," sunk in 40ft. of water, has been cut into four sections, and one of these, weighing 1500 tons, has been raised by Admiralty lighters and towed to the east of the harbour.

THE Safety in Mines Research Board has published a subject-index, with title page and table of contents of Volume VII. of its publications, comprising the ninth Annual Report, and papers Nos. 64 to 72, published in 1931. The index (price 2d.) can be obtained from H.M. Stationery House, Adastral House, Kingsway, London. Volume VII., complete with index, can be obtained from the same source, price 7s. 6d. net.

AT the invitation of the Department of Scientific and Industrial Research, the Reinforced Concrete Association has nominated Mr. H. E. Steinberg, M.Inst.C.E., to represent it upon the Reinforced Concrete Structures Committee which has been set up at the request of the London County Council "to review present methods and regulations for the use of reinforced concrete in building, and to make recommendations for rules or practice embodying the best available technical information and experience."

AN observatory that will house the second largest telescope in the world is to be constructed near Richmond Hill, Toronto, Ontario. The telescope was ordered over two years ago from the firm of Sir Howard Grubb, Parsons and Co., Newcastle-on-Tyne, England, and work on it is expected to be completed within a year. It is of the reflecting type, and the concave mirror will have a clear aperture of 74in. There will be three domes in the upper structure of the administration building, and in each of two of these a smaller telescope will probably be mounted, which will be complementary to the great machine in the separate building. The remaining dome will house three astronomical cameras on a single mounting.

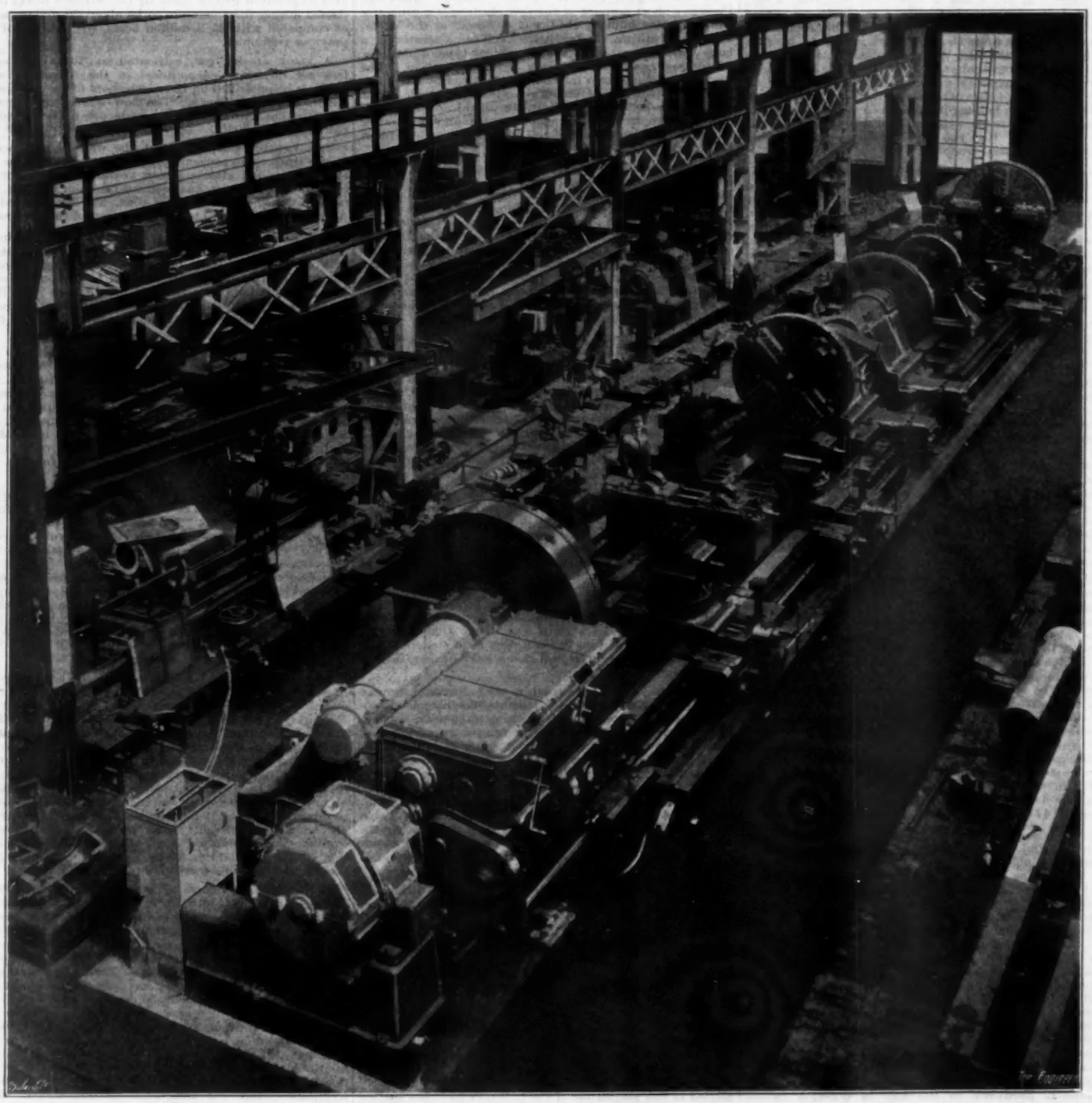
AN aerial survey of the Wanderer Consolidated property in Southern Rhodesia is, says the *South African Mining and Engineering Journal*, now being carried out by the Aircraft Operating Company. It is pointed out that mining groups in the Union have not been slow to take advantage of the immense benefits of this new method. One old-established tin mine (Rooiberg) which was on the point of closing down has reopened because the air photos revealed a main geological feature which all other forms of prospecting, including electrical methods, had failed to reveal. Both the Bailey and the Central Mining Groups are having considerable areas of concessions surveyed from the air, and now the goldfields, after careful examination of the possibilities, have been the first to employ these latest scientific methods in Southern Rhodesia.

IN the issue of the *South African Mining and Engineering Journal* of August 13th, it is noted that "the arrival of the 80-ton crane, which will cost the Government £26,000 erected, marks another stage in the process of making Durban harbour as up to date as any in the world. Several of the eleven cranes which were ordered to replace the hydraulic, which have operated for many years, have been erected and are now in service. Two 4-ton cranes for Congella are due about September, and the 25-ton self-propelling floating crane is expected to leave the Clyde about the end of this month. When Durban's new 80-ton crane is erected in Durban (between C and D sheds) it will provide the port with the largest crane in South Africa, the biggest at present being the 60-ton floating crane in Cape Town. Durban has a 50-ton hydraulic crane, but this is to be dismantled. East London has a 50-ton electric crane."

DOUBLE 50-INCH. CENTRE LATHE FOR RUSSIA

CRAVEN BROTHERS (MANCHESTER), LTD., REDDISH, ENGINEERS

(*For description see page 253*).



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NOTICES TO READERS.

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TWO ADDRESSES.

IN our last issue we gave a number of extracts from Sir Alfred Ewing's presidential address to the British Association in York. To-day we present in similar form the address which Professor Miles Walker delivered to Section G of the Association. The former deals with the advances that have been made in physics and mechanical science in the past hundred years; the latter, whilst describing technical progress, is given up in the main to sociological and political questions. Here and there, however, the two Presidents came on to the same ground, and it is interesting to observe the contrast between their attitudes. Sir Alfred sees, with a touch of sadness, the effect which "progress" is having upon civilised nations. "An old exponent of applied science," he writes, "may be forgiven if he expresses something of the disillusion with which, now standing aside, he watches the sweeping pageant of discovery and invention in which he used to take unbounded delight. It is impossible not to ask, whither does this tremendous procession tend? What, after all, is our goal? What its probable influence on the future of the human race?" After remarking that "there is a sinister side even to the peaceful activities of those who in good faith and with the best intentions make it their business to adapt the resources of Nature to the use and convenience of man," he concludes his address with this passage: "Where shall we look for a remedy? I cannot tell. Some may envisage a distant Utopia in which there will be perfect adjustment of labour and the fruits of labour, a fair spreading of employment and of wages and of all the commodities that machines produce. Even so, the question will remain, How is man to spend the leisure he has won by handing over nearly all his burden to an untiring mechanical slave? Dare he hope for such spiritual betterment as will qualify him to use it well? God grant he may strive for that and attain it. It is only by seeking he will find. I cannot think that man is destined to atrophy and cease through cultivating what after all is one of his most God-like faculties, the creative ingenuity of the engineer."

In these sentences there breathes the patient tolerance of a veteran who sees the frailty of men and yet believes that in the end they will win to something better. But he is in no haste to suggest remedies. He is content to wait in the firm confidence that somehow or other, at some time or another, men will be able to blend "spiritual betterment" with material progress. The contrast between this philosophic attitude and that of Professor Miles Walker is sharp. Professor Walker has a plan, cut and dried, for the improvement of the lot of mankind. Briefly it is that only those who are engineeringly minded should be trusted with the control of "economic and social matters." He is without toleration and rails upon the past and the present. "All through our 'civilisation' vested interests block the way to improvement," he exclaims. "Long after science has shown the way to make things better for the people, unintelligent control and stupid prejudice preserve the old evils and refuse to be convinced." Or again we may set the following passage, burning with certainty against the hesitation to dogmatise, which is shown by Sir Alfred Ewing. "One of the main things wrong with the inhabitants of the world, more serious than the inefficiency of their methods of providing themselves with material things, is the poverty of their outlook. The vast majority fail completely to look at life from the right point of view. They do not see its finest opportunities; they are almost blind to its greatest duties. The intellectual and spiritual sides of their nature are undeveloped." May we suggest that the Professor's enthusiasm has led him to rather unphilosophical impatience. The new conditions have come upon the world rapidly, in the space of a few generations, and it is not surprising that humanity has not yet made the best use of them. "The cornucopia of the engineer," says Sir Alfred, "has been shaken over all the earth, scattering everywhere an endowment of previously unpossessed and unimagined capacities and powers. Beyond question many of these gifts are benefits to man, making life fuller, wider, healthier, richer in comforts and interests, and in such happiness as material things can promote. But we are acutely aware that the engineer's gifts have been and may be grievously abused. In some there is potential tragedy as well as present burden. Man was ethically unprepared for so great a bounty. In the slow evolution of morals he is still unfit for the tremendous responsibility it entails. The command of Nature has been put into his hands before he knows how to command himself." This view of events seems to us to be the right one. Man for the time being is overpowered by material and scientific progress; he is unable to make the best of it. That, no doubt, was at the back of the mind of the Bishop who, some time ago, asked that the wheels of progress should be stopped for five years. He hoped that in that period humanity would have learnt how to accommodate itself to its new environment—both materially and intellectually. Needless to say, such a plan is impossible. "Progress" must and will take place despite the protests of those—a multitude—who centre their attention rather upon the ills which accompany it than upon the benefits which it has conferred upon humanity. Rather than throw away the gifts which science and technology are bestowing upon us with a too generous hand, we have to find means of using them in such a way that we may get the greatest possible contentment from them. Much of Professor Miles Walker's address is directed to that problem, and it will not be without interest to consider how far his plan is based on sound premises and what hope of success it holds out.

The address is entitled "The Call to the Engineer and Scientist," and, as we have already indicated, it condemns present administration in the bulk and claims that if only engineering-minded—eudemonistic—people were allowed to sit in Parliament or hold positions of responsibility the world would soon get rid of waste, see that everybody had everything he wanted, and increase the present proportion of intelligent people from the 20 per cent., estimated by Professor Walker from his own educational experience, to something nearer 100 per cent. The Professor follows Major Douglas in his detestation of the middleman. "The main business of the world to-day is," he says, "buying and selling. Things are manufactured to be sold at a profit. When prices are low, business is said to be bad. This shows how inverted is the position under our ridiculous system. It ought to be just the other way. Buying and selling should be a mere unavoidable incident in the distribution of wealth. . . . . Many attempts are made to justify the prices at which things are sold, but the real reason for high prices is that in a so-called civilised country there are only about 15 per cent. of the inhabitants making a real contribution to wealth; the remainder are hangers-on, such as landlords, merchants, retailers, servants of the rich and retainers of all sorts," with juveniles and pensioners. Professor Walker modifies this bald assertion somewhat in subsequent passages, but it still remains open to criticism. In the first place there is, we suggest, a confusion between prices and profits. Some luxuries apart, a continual effort to reduce prices is going on. Indeed, the principal purpose of the industrial revolution—as it is called—was, and is, the reduction of selling price. In many commodities high profits can only be secured by low prices—a big turnover—and even in general it might be said that no manufacturer or dealer complains of low prices if his gross profits are good. Prices fall when trade is bad, but trade is not necessarily bad when prices are low. Professor Walker holds that prices are high because too small a proportion of the population is engaged in manufacture, and too large a number in distribution. He gives a figure of 15 per cent. "making a real contribution to wealth." Now the number of "insured persons" last year was, in round numbers, 17 millions out of a population of, let us say, 50 millions. Hence to reach Professor Walker's estimate of 15 per cent. we have to assume that nearly 10 millions of insured persons are useless burdens upon society. We think such a contention would be hard to sustain. But we gather from other parts of the address that it is arrived at by assuming that a "cut" of at least 50 per cent. in all selling and distribution machinery would be economical. We suspect that if this proposition were put to Sir Francis Goodenough he would reply that selling organisations, far from being a burden upon society, are a real necessity, not only to industry, but to the purchasing public. Theoretically, no doubt, they are unnecessary. Money also is unnecessary, but an interminably long experience of the world has shown that both money and the shopkeeper are conveniences which are worth paying for. Here there enters a little human consideration to which due weight is not given by Professor Walker. "At present," he writes, "we have hundreds of men and women standing behind counters while customers are making up their minds as to what kind of ribbon to buy or how many yards of stuff they will want. Buyers should be encouraged and helped to do all this thinking before they ask for the goods." Manifestly Professor Walker knows little of the joys of shopping, but even he must sometimes like browsing upon the volumes in a bookshop and chatting with the shopkeeper about their contents. If so, it would be churlish to rob others of a similar pleasure differently directed. The world will be indeed a dull intellectual place when it does all its shopping with the precision of an engineer asking for a dozen ¾in. Whitworth screws! We mention this matter only because it is one of those little things which indicate that, like so many social reformers, Professor Walker is out of sympathy with those traits and weaknesses that give the charm and character to human existence.

One thing alone remains to be said. Professor Walker ends his address with the constructive proposal that "the Government should found an experimental, voluntary, self-supporting colony under the auspices of engineers, scientists, and economists." The idea is expanded in an excerpt which may be found on page 260. The experimental colony has been not only the imaginative plaything of the economist, but has been practically tested several times. It has never passed both criticism and practice, and if it succeeded in so doing it would, as Rousseau, who played with the idea, foresaw, be liable to reversal by what engineers nowadays would call "the scale effect." Rousseau, says Mr. Kingsley Martin, in his admirable "French Liberal Thought in the Eighteenth Century," "knew what economists have forgotten—that, while the consideration of a simple case may sometimes elucidate the nature of a complex problem, it cannot provide a solution for it. The economic problems of a million persons are not those of Robinson Crusoe multiplied by a million, nor can the political problems of a modern community of men be solved by a statement of conditions which would be ideal for a small community of gods."

A Serious Boiler Explosion.

IN the afternoon of February 29th last, whilst the steam tug "Agnes Seed" was lying alongside the Harrington Dock, Liverpool, her boiler exploded, killing the fireman and injuring two other

persons. The circumstances connected with the explosion are so grave that we consider it right to call marked attention to them. The boiler was of the familiar Scotch type, 9ft. in diameter and 11ft. long, with two furnaces, made of steel. It was constructed no less than forty years ago by Willoughby Bros., Ltd., of Plymouth, and had undergone certain repairs in 1911 and subsequently; the last repair was reinforcement by welding on the outside of the shell plates at the two bottom longitudinal seams. This work was done in June, 1922, and part in March, 1931. The boiler was designed for a pressure of 100 lb. It was completely destroyed by the explosion, the shell opening out along the bottom seam and being almost flattened out. The whole boiler was blown through the deck of the tug, landed on the dock wall, and fell into the Mersey. The hull was so damaged that the tug sank at her moorings. The cause of the explosion, according to the report of the Formal Investigation, was "the rupture of the bottom plate, which was a patch of several years' standing," owing to extensive grooving caused by corrosion.

These are the bare facts, but they are of less significance than the train of causes which led up to them. In 1930, the Manchester Ship Canal Company, the then owner, decided that the boiler was in such a wasted and deteriorated condition that it was not worth undertaking repairs upon it, and accordingly sold the tug complete for breaking up. The boiler was at that time insured with and inspected by the Vulcan Boiler and General Insurance Company, Ltd. After a thorough examination in 1930 the inspector entered the "stipulated working pressure" as nil; in other words, he condemned the boiler. At the end of the same year John Hornby and Sons, Ltd., of Bradford, bought the tug complete for £182 10s. for breaking up, and engaged Mr. J. H. Lamey, tug-owner, to tow her from Runcorn to Birkenhead. On the journey Mr. Lamey's son suggested that the vessel might be suitable as a spare tug in his father's business, and subsequently asked Messrs. Hornby if they would consider chartering her. Both parties were aware that the vessel had been sold for breaking up, and they must have seen a notice painted on the smoke-box door that the boiler was "Out of insurance. Not to be put in use." Subsequently, young Mr. Lamey, with an unqualified mechanic, made an inspection and reported that the tug was in "beautiful condition." Thereupon, Mr. J. H. Lamey chartered her for £15 a month. Hearing of this contract, Mr. W. G. Smith, the Canal Company's Chief Engineer, advised Messrs. Hornby that the boiler was not fit for use. Despite this warning the tug was put into service without any proper repairs, and was actually employed for over a year.

The Board of Trade has condemned Mr. Harry Hornby to pay £200 towards the cost of the investigation and Mr. J. H. Lamey to pay £100. "The history of this case," says the report, "affords a striking example of the enormous importance of the duty cast on the users of boilers, whether on land or water, of having a periodical inspection of their boilers made by a surveyor properly qualified for the purpose. The explosion of a boiler which is inspected by those having the necessary qualifications, and which is carefully looked after when in use, is of very rare occurrence. But if proper precautions are not taken, and if boilers are entrusted to the management and inspection of incompetent persons, they are instruments of vast potential danger to life as well as to property, and we wish most emphatically to impress these considerations upon all boiler users, and point out that their responsibility is a very grave one." We understand that the event has so impressed harbour authorities that steps are being taken to ensure that no boilers which have not passed proper inspection shall be allowed to make use of harbour facilities under steam.

The Call to the Engineer and Scientist.*

PROF. MILES WALKER, D.Sc., F.R.S.

ALL through our "civilisation" vested interests block the way to improvement. Long after science has shown the way to make things better for the people, unintelligent control and stupid prejudice preserve the old evils and refuse to be convinced.

There are many things to be ashamed of in our great cities. Not the least of these is the waste that goes on. There is waste of heat in domestic fires, waste of by-products in the consumption of coal, thereby producing dirt; waste of fresh air by pollution; waste of sunshine; and, above all, the waste of labour that might be applied in stopping all the other desolation and loss; waste of money by paying dole while there are obvious jobs for everybody.

If engineers were in control, they would so order matters as to neutralise this waste at the source. All soft coal should be treated by a low-temperature carbonisation process or some similar process so as to extract the gas, oil, and other by-products from it. People should be prohibited by law from burning soft coal, as they are in Paris. They would then be compelled to burn carbon in a bright cheerful fire making no smoke, or to use gas. Of course, it requires labour to do this, but the labour is available—why not use it? As things are at present in a district like Manchester, more than one hundred thousand housewives are making a continual fight against dirt. It is a hopeless fight, for every time they open a window black specks float in to settle and dirty everything. Patients at a nursing home are told that they cannot have the windows open because to do so dirties the curtains. The perfectly ineffective and hopeless labour of these housewives is ten times as great as the total labour required to treat the coal and extract the valuable by-products. Even if the carbonisation process carried out on a limited scale did not show a profitable return, the objections to it disappear when we contemplate the process carried out on such a scale as completely to rid our towns of smoke, and when the by-products are utilised in a national scheme.

The waste heat and power stations might be used in agriculture. A power station having an average load of 50,000 kW will waste more than 8000 million British thermal units per day. This is sufficient to warm 500 acres of greenhouses. Two very important items of cost in the forcing of vegetables are—(1) the capital cost of the greenhouses, and (2) the cost of heating. The capital cost to a nation possessing sand, lime, soda, and a surplus of labour need not be very great. If we can utilise the waste heat of power-houses to do the warming, we ought to be able to save hundreds of thousands per annum, at present sent to foreign countries for vegetables and flowers. At the same time, we could do away with the objectionable discharges from power-houses.

* * *

In this time of world depression the question not unnaturally arises whether the engineer (in which term I will include the scientist for brevity) cannot make a useful contribution towards the bettering of conditions—something more promising than the totally inadequate measures already proposed. I have chosen this subject because I believe that the application of the engineering mind to our difficulties is much more likely to lead to a satisfactory solution than hopeless debates and discussions upon side issues that have little to do with essential factors and problems. I propose then to consider shortly: (1) What is wrong with the world? (2) Why are the proposed solutions inadequate? (3) How could engineers make things better?

(1) There are so many things wrong with the world that I must here confine my remarks to the three main defects, the poverty in material possessions, the poverty in outlook, and the incompetence of the rulers.

Notwithstanding the fact that civilisation has been developing and extending for centuries, and the application of steam power to manufacture has been in operation for one hundred years, by far the greater portion of the inhabitants of Europe and America are very poorly supplied with the things that make life full, free, and enjoyable. Indeed, a very large number of these inhabitants exist in want and squalor; and in some cases the conditions of life are so insanitary and loathsome that we are tempted to ask whether civilisation is not a failure. If we go outside the modern states to the teeming millions of China and India we find that only a little has been done to improve the lot of the peasant, who still lives by bodily toil and receives no share of that fullness of life which we know to be possible when the machine lightens our labour and education opens the mind to the beautiful things around us. Even in cases where the machine has been introduced it has often brought about conditions more unhealthy than with the original peasant labour.

This is a very unsatisfactory result in view of the enormous natural resources available and the huge possibilities of manufacture and distribution of wealth with modern systems of transport. If there had been a central organisation looking after the world's welfare for the last fifty years, and if it had made as bad a mess of things as we find to-day, it would have been condemned as hopelessly inefficient. As a fact, we have had no central organisation, but only governments looking after the welfare of individual states—an easier task, one might suppose. Yet these governments have made this mess of things within their states.

In spiritual matters the failure has been as complete as with material things, but I will leave the consideration of this until later.

This failure of civilisation to attain its purpose is not surprising when we remember that the chief principle in operation has been "Every man for himself and the devil take the hindmost." This is supposed by some economists to be the only principle which will work satisfactorily and automatically. It certainly does automatically give the hindmost to the devil. There has not been any logical plan in the old states in Europe or in America to enable all citizens to create their own wealth and enjoy it. The word "wealth" is here used in its proper sense to denote the material things that contribute to man's well-being. And there being no plan, it is not surprising that things have come to their present pass.

The main business of the world, to-day, is buying and selling. Things are manufactured to be sold at a profit. When prices are low, business is said to be bad. This shows how inverted is the position under our ridiculous system. It ought to be just the other way. Buying and selling should be a mere unavoidable incident in the distribution of wealth. When prices are low it should be evidence of economical manufacture and distribution, and the standard of life should accordingly be higher. The main business of the world should not be to buy and to sell, but to make the things that men want and distribute them in the simplest way without adding any more to the cost than is absolutely necessary. At times when trade is supposed to be good, things are sold at three or four times the price paid to the people who make them, and as a consequence the people who make them cannot buy them, so there is a slump on the market. If things were sold at a price which represented the exact cost of manufacture and distribution, then all the people concerned in the manufacture and distribution would have money enough to buy all the things that they have made. They would go on making more and more and getting more and more wealthy. Instead of this many are out of work because the shopkeepers cannot sell the things that they have in stock. They cannot sell them because the people who make them and want them have not received enough money to buy them. Many attempts are made to justify the prices at which things are sold, but the real reason for high prices is that in a so-called civilised country there are only about 15 per cent. of the inhabitants making a real contribution to wealth; the remainder are hangers-on, such as landlords, merchants, retailers, servants of the rich and retainers of all sorts. Then, of course, there are the young people who are still being educated and the pensioners. The cost of supporting all the extra people must be added to the legitimate cost of manufacture and distribution.

Imagine a state in which the majority of the inhabitants are at work using the most efficient machinery. They can supply their material wants and the standard of life may be very high. If, on the contrary, only 15 per cent. of them are doing useful work, then the standard of life is necessarily lower. The mere fact that some of the inhabitants are very wealthy, and have a large amount of money to invest, does not help very much the man who is out of work and has no facilities for making the things he wants. It is not a solution to set him to make roads which he does not want. Nor is it a solution to make him into a gardener, a butler, or a footman. The rich man may flatter himself that he is giving work to one hundred people. He is possibly doing his best according to his lights, but he may be a part of a system which is withdrawing one hundred workers from the really useful tasks and thereby impoverishing the state. I say "may be" because some servants of the well-to-do are very useful members of society. The chauffeur who enables a master of industry to get about quickly may be doing more useful work than if he were employed in the factory. But the greater part of the money spent by the well-to-do goes into channels that do not contribute to the welfare of the State as a whole.

For all the inhabitants of a State to be as wealthy as possible two conditions are necessary:—

(1) Things that contribute to well-being shall be manufactured at the greatest speed possible at our present state of knowledge, and with the best appliances available.

(2) The method of distribution shall be so efficient that the people who make the things are able to buy the things that are made. Anything that interferes with the second condition will prevent the obtaining of the first.

Consider the hundred million inhabitants of the United States of America. They have at hand all raw materials, all food supplies, capital equipment in the way of factories, expert advisers and means of transport. What is to prevent every inhabitant from enjoying a very high standard of life? What is it that condemns the great majority of them to a very poor standard? It is the system of trading, in which most men are traders and only a few are real workers. And why are there so many traders? Because under the present rules it is more profitable to trade than to work. Alter the rules so that only the useful worker, useful distributors and providers of useful capital share the things that are made, and there will be hardly any limit to the material wealth of the individual.

In the past the engineers have been busy with their own jobs. They leave the making of the laws, the controlling of the State and the general management of things to the politician and the tub-thumper. This is especially so in the U.S.A., but most countries suffer from the absence of special intelligence and

* British Association. Section G.—Engineering. Presidential Address. Abstract.

expert knowledge in the make-up of their rulers. A man becomes a town councillor or a member of Parliament without any proper test of his ability to put two and two together or to arrive at a logical conclusion from a given set of premises. No test is imposed for the purpose of seeing whether or not he has the ability to tackle very difficult problems. The kind of mental training required to find the right solution of a difficult economic problem is exactly the same as the kind of training required to tackle engineering problems. How many members of Parliament could solve a simultaneous equation with three unknowns? And yet they are paid £400 per annum to solve problems involving many more unknowns. How many of them have the most elementary knowledge of the laws they are amending? When they voted for the Law of Property Act, 1925, how many of them understood it? How many of them have the most elementary knowledge of the scientific facts upon which the manufacture of wealth is based or have the organising ability that is necessary to carry through a great project? There are, of course, exceptions, but as a class, apart from lack of education, they have the wrong mentality.

* * *

I now come to the question, "How could the engineer make things better?"

A committee of engineers given control of the whole world would not attempt to tackle the whole problem at once. The world would have to wait for the growth of an organisation operating at first over a small area, and extending as it gained experience.

A suitable place to begin might be one of the states of North America, already provided with most of its raw material. Or it might be better to begin in Europe. France would be suitable, as it is already nearly self-supporting, but only a small self-supporting part of that country would at first come under the scheme.

An estimate would be made of the standard of life that could be obtained by the average inhabitant provided he worked well and was aided by the best machinery and organisation. A promise would then be made to provide the houses, furniture, clothing, food, fuel, education, and entertainment in exchange for the services of the individual. Payment would be made by cheques, the nominal values of which would be adjusted on the low side so as to allow for accidental losses and defective workmanship. Though the State would need a gold backing for these cheques to begin with, the real backing of the cheques would be the wealth produced. The cheques would be honoured by the production of the goods and not by the production of gold. A man working well for a year might earn cheques valued at 40,000f. Some of these he would exchange for food and necessities; but after each one had done his share of the work he would enter into his inheritance and the cheques would be balanced against the things he would receive.

To get over labour troubles the arduous duties would be given to all the young men and women irrespective of class. The greatest honour would go to those who did the most arduous tasks.

There is a spirit of adventure in youth that makes the taking on of new work easy. Anyone who has lived in a mining village knows the eagerness with which a young miner takes up the work to help his father. The learning of new processes in our factories by young hands is in most cases a matter of a few weeks. Only in some specially skilled trades does it take long to become expert. The machine is fast taking the place of the expert craftsman. The number of years that young men and women would be required for manual work need not be too great in these days of machinery, and the number of hours' work per day would be few. A very high standard of life can be earned in a few hours of work per day when all are useful workers and all operations are carried out in the most efficient manner. Think of all the young men and women standing behind counters in shops all over the civilised world. Not one-quarter of them would be required under a really efficient system of distribution. The other three-quarters should be at work a few hours a day, contributing their share to the work of the world. Some of the hours not required for manual labour would be given to higher education, and it would, of course, be possible to give special facilities to the best brains and put them to do intellectual work. Physical culture would form a part of the day's programme for all young people.

The present factories need not pass out of the present management. That is in most cases very efficient. But the object in view would be to produce goods wanted by the people. Many factories at present concentrate more on making a profit than on making commodities that are useful to the buyer. Interest would be paid on the capital invested in factories and other undertakings. That interest would be paid by cheques and the cheques would be honoured by commodities or other services rendered. The fundamental idea in the scheme is, of course, that all wealth comes from the soil by the application of labour and intelligence, and it is possible by good organisation to create and distribute ten times as much wealth as is being done at the present time. In a country like America, where they have available vast natural resources and manufacturing facilities, the average standard of life should not be less than the equivalent of three thousand dollars per annum. This comfortable state of affairs does not exist in the United States or in any other states. The reason is that no arrangements are made whereby everyone does his share of the work; and even when a man does his share, and more, he very often does not get his share of the product. Things will never be better as long as they are controlled by people who are not engineeringly minded. These people talk about "over-production," "low prices," "effect of the gold standard," and other things that are mere incidents. They have not enough logicality to see the real cause.

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One of the main things wrong with the inhabitants of the world, more serious than the inefficiency of their methods of providing themselves with material things, is the poverty of their outlook. The vast majority fail completely to look at life from the right point of view. They do not see its finest opportunities; they are almost blind to its greatest duties. The intellectual and spiritual sides of their nature are undeveloped. This is partly due to the exhaustion of effort in their struggle for existence, a struggle which ought to be lightened in the way I have indicated. But this is not the only cause of the poverty of outlook in the vast majority of mankind. It is in a great measure due to the inefficiency of their teachers and especially of their religious teachers.

* * *

The education of the young is a duty that must be approached with great discretion. After twenty years' experience of the students who present themselves for evening classes, I assert that not more than one-fifth of the inhabitants of this country will follow a simple logical argument, even when it is about a subject in which they are interested. The remainder will let their minds wander and will take a result on trust without even hoping to understand it. This I attribute in a great measure to the fact that in their early years their reasoning powers, so far from being encouraged, were actually wrecked on the snags of unreasonable studies.

Education should be directed much more than it is at present to the making of young people into happy and useful citizens. To this end the subject matter of education should be concerned more with the things around us than with the things of the past. History, of course, should have a place in education, but it should be valued mainly for its bearing on the present. The curricula of schools have been very greatly improved during the last few years, but there still remains a great deal to be done before we can say that we take the shortest and most reasonable way to learning. When that shortest and most reasonable road has been gained it will be found that boys and girls are carried much further and made into much happier and more useful citizens.

Some of my hearers may wonder why I have not confined my presidential address to Section G of the British Association to the subject matter of engineering. It is because at this stage of the world's misfortunes, with output falling and unemployment figures rising, the engineer has an important message to give.

You ask for a constructive proposal. It is that the Government should found an experimental, voluntary, self-supporting colony under the auspices of engineers, scientists, and economists. The object in view would be to ascertain how far it is possible with our present knowledge and the best methods of manufacture and distribution for a group of, say, 100,000 persons to maintain themselves and continually to increase their wealth when freed from the restraints and social errors of modern civilisation. Such an experiment might do more to enlighten the world as to the possibility of modern logical methods than an experiment carried out on a continent thousands of miles across, where unforeseen difficulties might easily defeat the best intentions. If you ask what differences there would be in the old world and those of the new colony from which so much is to be hoped, I will in partial answer draw two pictures. One is of a feeble man of sixty years working all day in a sewer because it is the only occupation he can find to earn his daily bread. Far worse than the unpleasantness of the task is the rankling injustice that he should be compelled to do this despised job for no more reward than a living wage, while others with easier tasks get greater rewards. The other picture is that of a young man of twenty-three years, who has chosen the task of sewerman in the spirit of those who went to the trenches in 1914. Sir Sewerman aided by modern appliances cheerfully puts in his three hours of unpleasant work and for the rest of the day disports himself and extends his education.

So with all the work of mankind. It can be done cheerfully when justice seasons its incidence.

Literature.

The Newcomen Society for the Study of the History of Engineering and Technology: Transactions, 1929–30, Vol. X. Published by the Society, the Science Museum, South Kensington. Price 20s.

THIS is the tenth volume of "Transactions" of the Newcomen Society, and covers the year 1929–1930. Those are notable facts. They show us not only that the Society will next year enter its teens, but that it is in such a flourishing condition that for each of the first ten years of its existence it was able to bring out a volume of "Transactions." To those who are familiar with the successive issues, we need not say what that means. The volumes are stout, attractively printed on a good paper, well illustrated, and give much more than the papers and discussions of the session. There are nearly always some pages devoted to Communications upon historical matters, and the Analytical Bibliography of the History of Engineering and Applied Science, the eighth part of which is printed in the present volume, is alone a valuable feature. The present is an even stouter book than its predecessors, for the Society very wisely decided to include in it an index of the first ten volumes, and has done the work admirably.

A paper which is bound to attract the attention of all who follow the history of engineering is one presented by Messrs. Clarence O. Becher and Arthur Titley in October, 1929, and entitled "The Valve Gear of Newcomen's Engines." In it we note that the authors throw some doubt upon the traditional story of how jet condensation of steam was discovered. It is clear that they are ready to take a more generous view than Desaguliers and Triewald, of whom the first puts it down to a pure accident and the other to the "direct intervention of Divine providence." Several drawings of Newcomen valve gears are given, and show the progress that was made with it. The authors express a fear that the truth about Humphrey Potter will never be cleared up. It is even uncertain what the Scoggan, which Potter is alleged to have added to the gear, is. They add, "Unfortunately, Barney, in his humorous explanation, 'Scoggen and his Mate that work Double to the Boy γ is the Axis of Him,' omitted to show γ on his drawing, and so increases the cryptic nature of his reference."

This paper is followed by an American contribution by Mr. L. F. Loree on "The First Steam Engine in America." It was a Newcomen, built in 1753 under the supervision of Joseph Hornblower, and was set up at the Schuyler copper mine in New Jersey in 1755. Then comes a note by Mr. Rhys Jenkins on d'Acres "Art of Water Drawing," a little book of 1660, which has already appeared in facsimile as an extra-publication of the Society. An interesting paper by Mr. A. A. Hughes on Bell Founding follows, and is succeeded by an entertaining discourse on "Pioneer Ships of the Atlantic Ferry," by that well-recognised authority Engineer-Captain Edgar C. Smith. Mr. Titley then appears again with a paper on "Richard Trevithick and the Winding Engine," and a paper by Major E. A. Marples on "Ancient Civilisation," brings the actual Transactions to an end. There are, however, several Notes and Communications, amongst which the Diary of John George Bodmer (1816–17), edited by Mr. H. W. Dickinson, must be mentioned. Bodmer was a partner in a general engineering works at St. Blaise, in the Black Forest, and visited this country partly to see what he could pick up and partly to exploit his breech-loading cannon. He spent some strenuous months in England making notes and drawings, but most unfortunately nothing of the latter, save the titles, have been preserved.

BOOKS RECEIVED.

The Strength of Materials. Second edition. By J. Case, M.A. London: Ed. Arnold and Co., 41 and 43, Maddox-street, W. Price 30s. net.

Induction Coil Theory and Applications. By E. Taylor Jones, D.Sc. London: Sir Isaac Pitman and Sons, Ltd., Parker-street, W.C.2. Price 12s. 6d. net.

Reinforced Concrete Designer's Handbook. By Chas. E. Reynolds, B.Sc. London: Concrete Publications, Ltd., 20, Dartmouth-street, S.W.1. Price 15s. net.

The Roadway Goods Transport Guide for Great Britain, 1932–3. London: Roadway Publications, Ltd., Polebrook House, Golden-square, W.1. Price 12s. 6d. net.

The Testing of High-speed Internal Combustion Engines. Second edition. By A. W. Judge. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C.2. Price 25s. net.

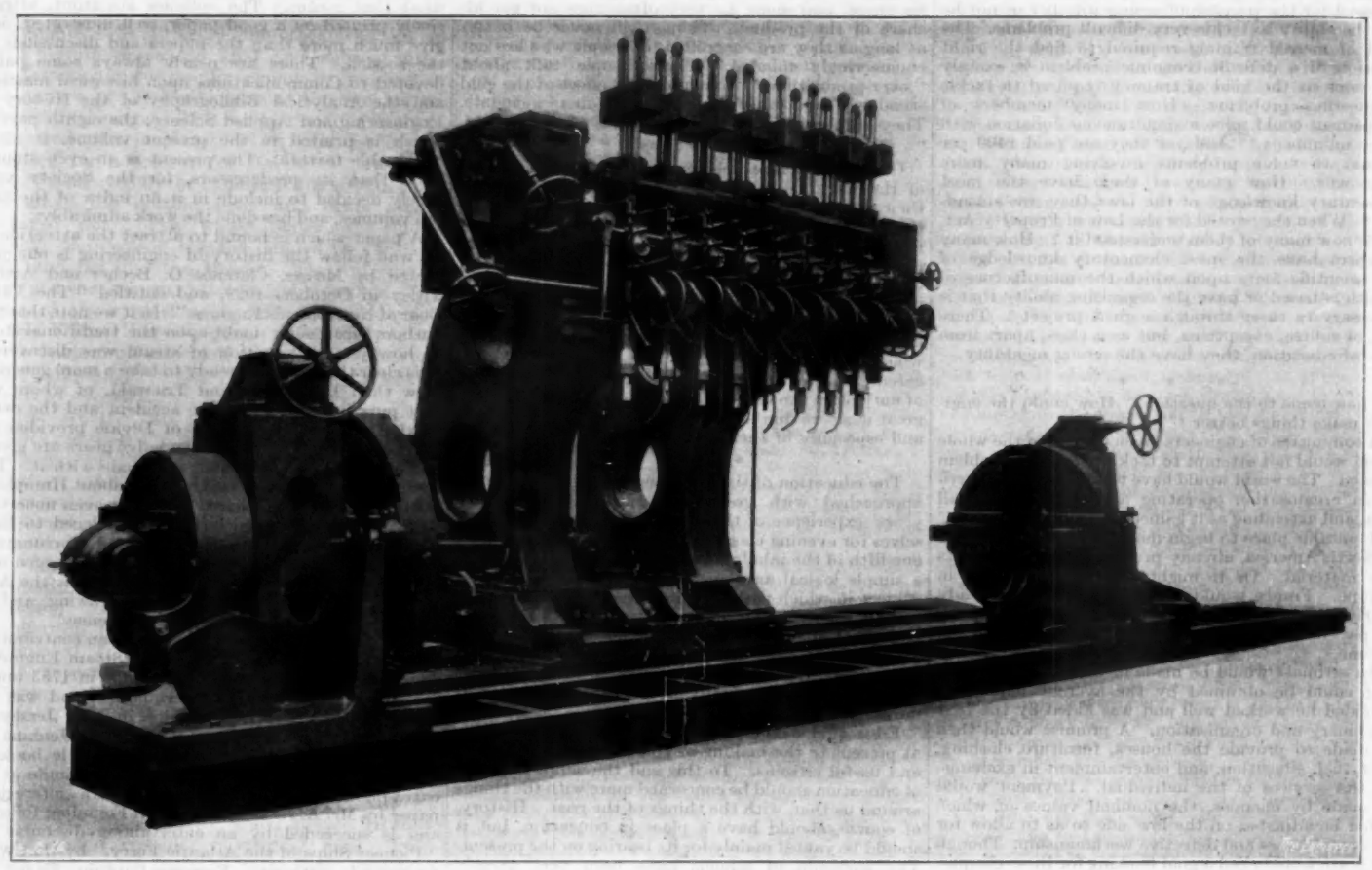
Mineral Resources of the United States, 1929. *Part I., Metals; Part II., Non-metals.* Washington, D.C.: Superintendent of Documents. Price 1·50 dollar each volume.

Dominion of Canada National Ports Survey, 1931–1932. Report by Sir Alexander Gibb, G.B.E., &c. Ottawa: F. A. Acland, Printer to His Majesty the King. Price 1 dollar net.

SHIPS AND SHIPBUILDING.—Under this title, Barclay Curle and Co., Ltd., of Clydeholm Shipyard, Whiteinch, Glasgow, have issued an attractive album illustrating the past and present activities of the firm. Although the association of the company with the Clyde shipbuilding industry, which goes back over 114 years, has not been overlooked, the modern outlook is rightly emphasised, and some useful information concerning the present shipbuilding and ship-repairing facilities of the firm is given. The Clydeholm Yard has been altered and refitted, giving improved berths for ships up to 700ft. in length, and better transport facilities, while, at its Whiteinch Engine Works, the firm possesses an up-to-date marine engineering establishment capable of constructing all kinds of propelling machinery. Alongside the works is a fitting-out berth served by a 150-ton hammerhead crane. Repair facilities are being greatly extended at the Elderslie establishment, where a 620ft. graving dock, with the latest dock equipment, is being built alongside the Elderslie dock. The album contains one or two pictures of historical interest, and illustrates a wide range of Barclay Curle ships, one of the last being the "Courland," constructed for the Leith, Hull and Hamburg Steam Packet Company's service between Leith and Hamburg.

MULTIPLE SPINDLE TUBE-HOLE DRILLING MACHINE

NOBLE AND LUND LTD., FELLING-ON-TYNE, ENGINEERS



South African Engineering Notes.

(By our South African Correspondent.)

Huge New Head Gear for Mine.

THE two main shaft head gears of the Randfontein Estates Mine, the northern and southern vertical shafts, are being pulled down and replaced by modern steel structures. The work of erection and dismantling is being carried out simultaneously, and as a new steel girder is placed into position so an old wooden counterpart is withdrawn. These two shafts deal with nearly 70 per cent. of the total mine tonnage, and if either were out of action there would be no dividend paid. The engineers had therefore to devise some means of erecting the new structures over the old, and at the same time not interfere with the present hoisting arrangements. The shafts are served by 7500 H.P. steam Markham hoists, having 14ft. diameter drums with 2in. Lang's lay ropes of 190 ton breaking strength. Two cages, weighing 14,180 lb. each are in use, each capable of carrying 90 passengers per trip, or the equivalent of 13,500 lb. Every day 5300 persons are lowered and raised by each hoist, together with all the necessary timbering, drill steel, and material. Rock hoisting is done by means of 5000 H.P. Ward-Leonard electric hoists with 12ft. diameter drums, the ropes being 1¾in. diameter and 6000ft. long, with a breaking strength of 147 tons, the speed being up to 4000ft. per minute. The average daily travel of each skip is 600 miles, while the daily duty of the ropes is 12,683 million foot-tons. Duralumin skips are used, each of which weighs 7800 lb., as compared with 10,430 lb. for a steel skip. It speaks well for the engineers in charge that a record tonnage was crushed by the mine last May, during which period the construction had reached a critical stage.

Dynamite Train Wrecked.

On Sunday, July 17th, thirty-four trucks loaded with 310 tons of dynamite were dispatched as one train-load from the Somerset West explosives factory of the De Beers Company near Cape Town. When passing through Leeuwdoornesstad a tremendous explosion took place, every truck being destroyed and the guard of the train and a couple of people not far away killed. Just before the explosion occurred smoke was observed to be issuing from one of the trucks, but before a warning could be given the explosion took place. The theory most favoured as to the cause of the explosion is that an axle broke, but the formal inquiry has not yet been concluded. The force of the explosion was such that a trench about 15ft. wide and about the same in depth and over 100 yards long was excavated by it. There appear to have been two distinct reports, following each other closely. It has been definitely established that the explosions were heard nearly 400 miles away, reports having been received from Kokstad, in the Cape Province, and from villages and native kraals in Bechuanaland, and also up to the boundary of Southern Rhodesia. The damage done runs into many thousands of pounds. A similar explosion occurred at Braamfontein, on the Rand, in 1896. On that occasion, owing to there being much more property in the vicinity of the disaster, the damage caused was considerably greater and there was more loss of life. A huge pit resembling an open quarry was also excavated on that occasion.

Electricity Supply Commission.

The following particulars of the equipment of the Electricity Supply Commission's power stations have just been supplied:—Salt River (Cape), three 10,000-kW turbines and an additional 20,000-kW set have been ordered recently; Witbank (Transvaal), five 20,000-kW turbine sets; Congella (Natal), three 12,000-kW and two 6000-kW turbine sets; Sabie (Transvaal), three 450-kW hydro-electric sets. With regard to the Salt River system, the Commission is flinging out an extensive network of lines into the rural districts to give supplies to numerous towns and villages. The former include Paarl, Stellenbosch, and Malmesburg. The works of the Cape Explosives Company near Somerset Strand draw the major portion of their power requirements from the Commission's lines, and a scheme has been completed for taking electricity to a number of farms in the Erste River Valley. On the Natal system (Congella) development is proceeding all the time. The towns of Ladysmith, Estcourt, and Maritzburg have done away with their own power stations, and even Newcastle, which lies some distance from the northern terminus of the electrified section, has followed suit and is now supplied through a tender line pushed out from Glencoe for that purpose. The Witbank power station is staffed and operated by the Victoria Falls and Transvaal Power Company under an agreement with the Commission. The operating company buys the major portion of the output, and the station is linked with the other power stations of the Victoria Falls Power Company—Vereeniging, Rosherville, Limmer Pan, and Brakpan. The Commission has, however, constructed an extensive distribution network in the Witbank district and supplies not only the towns of Witbank and Middleburg, but also a large number of collieries and the very important carbide factory near Witbank.

Water Supply for the Rand.

The Rand Water Board has decided to increase the water supply taken from the Vaal River to supply the Witwatersrand by a third instalment of 5,000,000 gallons per day. The Board's main reservoir in the Vaal River has a capacity equal to the supply of 20,000,000 gallons per day, and this extension will make the total quantity to be delivered to the Zwartkopjes pumping station 15 million gallons daily. It is considered that the extensions in progress will establish the water supply position until 1935, or probably later. The additions and alterations, with the plant of the Rand Water Board now being carried out under the scheme, are as follows:—River intake station, one electric motor-driven vertical-spindle centrifugal pump, capacity 10 million gallons per day, together with screens, valves, accessories, and building alterations; main pumping station, one set of combined horizontal type of sedimentation tanks, together with flumes and mixing chamber, estimated to cost £13,000; a battery of six filters capable of treating 5,000,000 gallons per day, complete with housing; one water-tube boiler having a steaming capacity of 16,000 lb. per hour, complete with foundations and coal bunker, estimated cost £4500; one steam turbine-driven centrifugal pump having a capacity of 10 million gallons per day, estimated to cost £12,000; extensions to pump house for the full 20 million gallons per day scheme, together with one electric motor-driven centrifugal pump having a capacity of 10 million gallons per day, estimated to cost £3000. Pipe lines: at present there are two pipe lines connecting the Vereeniging station with the Zwartkopjes pumping station. These pipe lines are each composed of two sections, 70,000ft. of 22in. and 24in. diameter pipes respectively. Each of these pipe lines, capacity is 5,000,000 gallons per day. Under the extension scheme alterations are to be carried out to one of these pipe lines to convert its capacity from 5 to 10 million gallons per day. This is being effected by replacing the existing 70,000ft. of 22in. diameter pipe by 31in. diameter pipes, lifting the 22in. pipes and relaying them from the end of the 31in. pipes to Zwartkopjes, so that one pipe line will consist of 70,000ft. of 22in. and 70,000ft. of 24in. diameter pipe, having a capacity of 5 million gallons per day, and the other pipe line will be composed of 70,000ft. of 31in. diameter pipe discharging into two sections, lying side by side, of 24in. and 22in. pipes, each 70,000ft. in length. The capacity of the last-mentioned pipe line will be 10 million gallons per day. The estimated cost of the pipe line alterations is £115,000 and the total cost of the whole scheme is estimated at £179,500.

New Mine on West Rand.

There is a report, which certainly appears to have considerable foundation, that an amalgamation of the Durban Roodepoort Deep and the New Steyn Estate, on the West Rand, is being considered by the interests owning those areas. Some time back negotiations were undertaken by the General Mining and Finance Corporation and the Durban Roodepoort Deep with a view to bringing about the amalgamation of this holding, but the negotiations did not result in the formation of a workable scheme. It is, however, understood now that the consolidation of the New Steyn Estate and the claims, or at any rate some substantial portion of them, previously held by the Roodepoort United Main Reef is under consideration and that amalgamation with the Durban Roodepoort Deep is again being discussed. If this goes through yet another new mine will be added to the three which have just been carved out on the Rand and upon which development will soon be proceeding, and this new mine, when brought to production, will have a crushing capacity of about 60,000 tons per month and will add at least £70,000 per month to the total output of the gold mines of the Rand.

Passenger Transportation.

In a number of large centres in the Union the transportation of passengers is receiving much consideration to-day, and it is clear that while the rail tramcar will continue to be employed in thickly populated areas of the cities, where it is at present established, the use of such cars is not likely to be extended to new suburbs and areas into which surplus population is flowing. Bloemfontein has adopted trackless tramcars already, and the town of East London has now decided to provide motor

omnibus services to replace the present tramway system of transport. The town has just received authority from the Administrator of the Cape Province to raise a loan of £23,000 for the purpose of providing a certain number of the motor omnibuses for a start. Johannesburg has under consideration the changing of passenger transport in certain areas where the municipality is making huge losses. The idea is that the modern crude oil or petrol omnibus is best, and the Council's Transport Committee states that the question of scrapping trams has to be faced; only then will the city be able to compete with the people who are using omnibuses against the municipal trams. The Transport Committee has therefore decided that the Council shall obtain prices of the most modern types of omnibuses of various designs in Britain. The Committee also considers that in regard to trams on established routes improvement is necessary, and it therefore advises that the Council also obtains prices of the most modern types of these, as well as of the special plant used for stamping out light steel bodies. As far as possible the Committee favours the manufacture of cars locally, but before setting up expensive plant it is felt that full inquiries should be made as to costs and the comparative merits of the various types of transport now in use. The question of buying more omnibuses has therefore been held over pending further inquiries into the merits of the various makes. The Portuguese town of Lorenco Marques is also going into the question of passenger transport. The Mayor of that town recently visited the Union to inspect trackless tram systems, and has now issued a report strongly favouring the adoption of the system in place of the electric rail trams and omnibuses, and the Town Council has adopted the report. In Cape Town the tramway company had decided to run trackless trams on certain new residential areas where no transport had hitherto existed. The initiation of such a service has, however, been held up by the Road Transportation Board, a body which appears to have as its chief object the prevention of any road transportation that may interfere with the earnings of the railway. The Board has already stopped a number of private transport companies from carrying goods by road between points served by the railway, even though the road transportation often takes only half the time and costs much less than rail. Until now, however, the Board had not interfered with tramway companies. In this instance it acts under power given by Parliament, by which it can refuse to allow road transport over a route where trams have not previously run. The proposed new trackless trams would, it appears, have to run for some 800 yards over a route not previously covered by the company, and so the Board has taken advantage of this and has, so far, refused permission.

Mechanisation on the Mines.

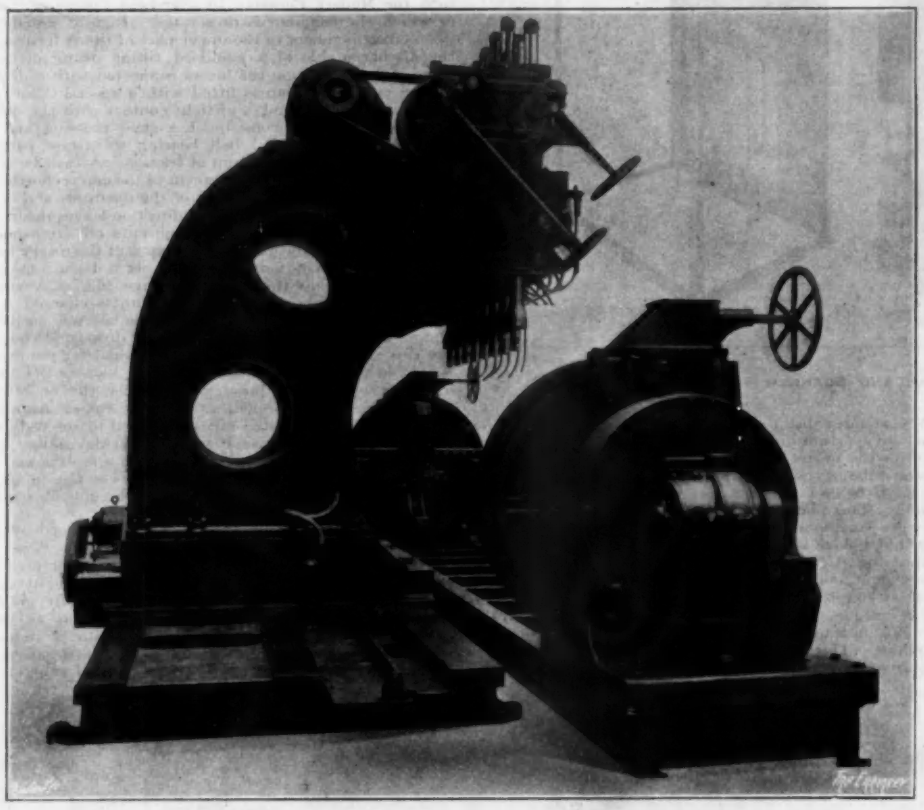
The Inspector of Mines in the Brakpan district states in his annual report that mechanisation of the mines is becoming so general that it is no longer an event to see big development ends and stopes cleared out within a fraction of the time formerly required, and with a labour complement which a few years ago would have appeared impossible.

Trade Improving.

Trade prospects have been regarded much more optimistically during the last month or so and a substantial recovery is being forecasted by many leaders in commerce, trade, and industry. Among these is Mr. J. R. More, the General Manager of Railways, who points out that the fall in traffic receipts has been arrested and that exports are increasing, while the price of wool has advanced somewhat. A number of merchants and industrialists also report improvement, especially in the footwear industry, which is now producing 30 per cent. more than at the end of last year, though still considerably below normal. Wholesale merchants find orders coming in better and for larger quantities, and it looks as if the improvement noticed here and there has had the effect of making people more ready to purchase than has been the case for a long time. Agricultural prospects are good, with larger crops of wheat, maize, fruit, &c., while the advance in the price of cotton will help those farmers growing cotton. The crop last season was about 8000 to 10,000 bales. One result of the improvement, if it continues, will be that many important projects held up owing to inability to finance them will be proceeded with, which should mean substantial orders for engineering and other firms in Britain.

A Large Multiple Spindle Drilling Machine.

A LARGE multiple-spindle tube hole drilling machine, made by Noble and Lund, Ltd., of Felling-on-Tyne, is shown by engravings on this and the opposite page. It is equipped with eight drilling spindles, each of which is fitted to a separate drill head adjustable for centre distance on a common slide. These drill heads, made of cast steel, can be brought within 7in. centres, and the adjustment may be made collectively or individually. The collective adjustment is operated by a ratchet lever on the end of the front slide, which moves the heads through an arrangement of worms and worm wheels of different pitches. A friction clutch on each worm wheel may be uncoupled when it is desired to adjust the heads separately. The drilling spindles are made of nickel chrome steel and mounted upon ball bearings. They are revolved by means of spiral gears driven from a horizontal shaft. The gears are enclosed in an oil bath and ball thrust washers are provided for taking the end thrust. A gear-box mounted on the left-hand end of the front slide provides six rates of revolution to the spindles. Power is obtained from a constant speed motor mounted on the top of the casting supporting the drill heads, and connected to the gear-box through multiple V ropes. An independent feed motion is provided for each spindle together with an automatic knock-off motion and a quick return. The feed gear-box giving six rates of feed and a reverse is mounted at the right-hand end of the front slide. The eight spindles can be brought down to the work by hand and the feed for all engaged simultaneously. Two massive columns, which are bolted to a bottom slide, support the front slide, and may be cross-adjusted on an intermediate slide between the bottom slide and the bed-plate.



END VIEW OF MULTIPLE SPINDLE DRILLING MACHINE

The bed-plate is wide and has three slide ways, the middle one of which acts as a guide. Motors are mounted upon the slide for the power longitudinal and transverse motions of the drill heads, and are controlled by push-buttons conveniently situated for use by the operator. The left-hand headstock is fixed to the built-up front bed-plate, while that on the right is adjustable by power along the bed to suit the length of the drum to be drilled. Each headstock is equipped with large face-plate type chucks carried by large diameter spindles. The drum is gripped by the four steel jaws fitted to each chuck, which are operated by large screws. The left-hand chuck may be revolved by an auxiliary motor controlled by push-buttons, and hand vertical adjustment of each head is available for lifting the drum to the required height.

Two motor-driven pumps provide a complete water service for supplying cutting lubricant to the drills. One pump delivers the cutting lubricant from a sump in the foundations to a channel trough in the bed, while the other delivers it thence to the drills, the use of long lengths of flexible hose being thereby obviated.

The principal dimensions of the machine are given in the following table:

Principal Dimensions.

Diameter of spindles	2¼in.
Min. centres of spindles	7in.
Max. „ „ „	14in.
Spindle speeds, 6 rates, r.p.m.	30 to 250
„ feeds, 6 rates, cuts per inch	50 to 150
Longitudinal traverse of drill head	23ft.
Transverse „ „ „	3ft.
Length of bed for drill head	32ft.
„ „ „ drums	45ft.
Vertical travel of spindles	1ft. 6in.
Max. dia. of drums admitted	4ft. 6in.
Min. „ „ „	2ft.
Max. length „ „	30ft.
H.P. of Main Motor	40
H.P. of aux. motor (cross adjustment)	5
„ „ „ (longitudinal adjustment)	5
„ „ „ (movement of chuck)	3
„ „ „ (revolving of chuck)	3
Speed of motor	40 cycles, 770 r.p.m. / 50 cycles, 950 r.p.m.
Approximate weight	45 tons

Protected Steel Sheets.

WE have received from the Lysaght Protected Steel Company, Ltd., of Newport, Monmouthshire, a sample of protected corrugated steel, suitable for roofing and similar purposes. Asphalt compound is stated to be absent from the protective coating, which is formed by applying vulcanised fibre to a steel surface in such a way that it becomes an adherent part of the whole. The whole surface, in which is included all the edges, is covered by the protection. The new material has been produced as the result of seven years of joint research work carried out by the Dunlop Rubber Company and John Lysaght, Ltd. For decorative purposes it can be supplied in a number of colours, and besides corrugated sheets can be formed into flashings and roofing tiles, ventilators and guttering. Ordinary oil paint may be applied to it without priming, and it may be colour-washed or lime-washed. The makers claim that the material is unaffected by acids, alkalies, salt or fume-laden air, tropical heat, or Arctic conditions. The protected steel sheet is supplied in five thicknesses, ranging from 18 to 26 gauge.

Balsa Wood.

WE have before us as we write a small block of wood, 4in. by 2¼in. by 2¼in., sent to us by the Balsa Wood Company, of Kingsway, London. It weighs only a fraction over 2 oz..

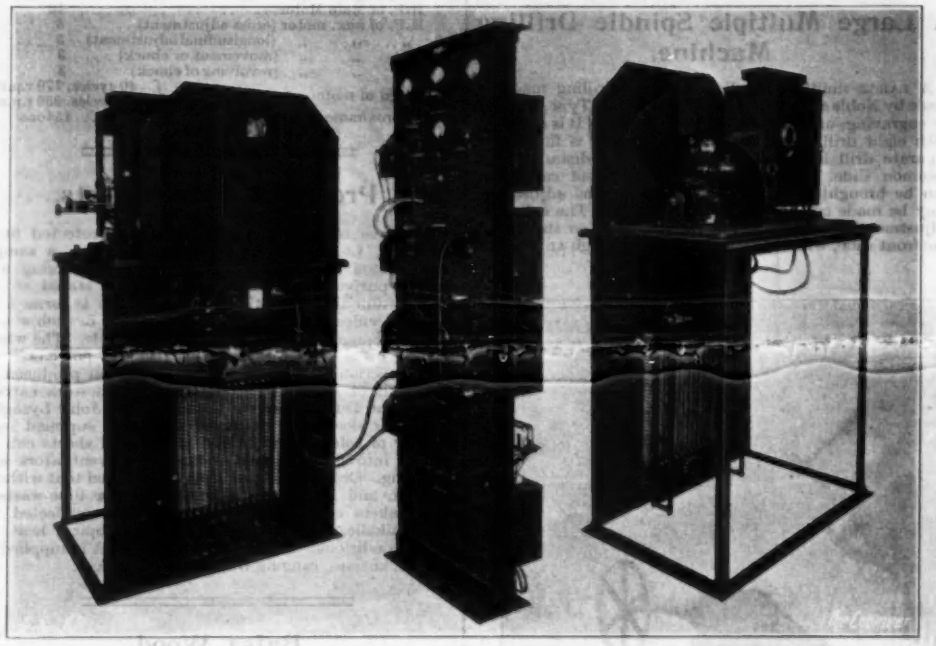
Balsa wood is a timber of which there are several varieties, very widely found in the States of central and northern South America. The best comes from Ecuador and carries the botanical name of *ochranhama lagopus*. The lightest timber requires a climate which is extremely hot, and which has a very heavy rainfall at the same time. Attempts have been made to grow this tree in the Botanical Gardens at Kew, and also in the United States of America, but so far with little success.

In the early days of the marketing of Balsa wood reliance was placed on the natural supplies. Its growth is extremely rapid, as can be seen when the grain of the wood is examined, a tree of 50ft. in height and 3ft. diameter being obtained in about four to five years. The best timber comes from trees about four years old, and planks are obtainable which are as light as 4 lb. per cubic foot. In such wood the empty cells of the timber can be seen quite easily and any such wood is remarkable for the rapidity with which it will absorb water. It was realised, some years ago, that the natural supply of the timber brought in by the Indians would soon be nearly exhausted. Therefore, a considerable amount of experiment was carried out to obtain Balsa wood planted in selected ground from seeds taken from the wild variety, the growth of the timber being very carefully watched as time went by and the trees only cut when they reached maturity. By this method a very great deal has been done to improve the standard of the timber exported. Planks as long as 18ft. by 18in. by 5in. thick are now obtainable. These planks are perfect and entirely free from the brown core found in the very centre of the tree, which has given so much trouble in the past. They are also free from splits and thunder shakes. The average weight of the timber works out at about 7 lb. to 8 lb. per cubic foot, and it has considerable strength. It is utilised in all sorts of constructional work, in boxes, chests, panelling, &c. As a comparison cork weighs about 11 lb. to 13 lb. per foot cube, and has very little constructional strength. The timber, on being felled, is stripped of its bark. It is very full of sap and, consequently, very heavy compared to the dry wood and it is logged down to the coast in the same way as many other varieties of timber. It is ripped up into rough sawn planks 6ft. to 15ft. long, 6in. to 15in. in width, and 1in. to 4in. in thickness, and is shipped in that condition to the United States of America or Europe, as the case may be. There it is again carefully examined and selected for the various purposes to which it is put.

In industrial life, the timber is being increasingly used and is found in aircraft work, boats, trunks and panelling, &c., and we are told that it makes an excellent razor strop! It is suitable as packing for all types of polished and delicate objects, as the silky texture of the timber does not scratch a surface, however smooth. It is used as sound-proofing for rooms, electric motors, &c., and as insulation against heat for all classes of insulation work, particularly where cases and vans are in question as the saving of deadweight is considerable. In particular, it is to be found in extensive use for the storage or transport of solid carbon dioxide. Its thermal conductivity is at the rate of 0·31 B.T.U. per hour per square foot for timber in 1in. thick panels. Here, again, it is seen that it compares very favourably with cork, which has about the same thermal conductivity.

Demonstration of Marconi Television.

A SYSTEM of television by wireless developed by the research engineers of the Marconi Company was demonstrated for the first time during the meeting of the British Association at York. Television images were transmitted by wireless from the Marconi Works, Chelmsford, to St. Peter's School, York, a distance of 180 miles. The wireless demonstration took the form of sending verbal messages from characters printed on a moving tape, which was passed through the transmitter at Chelmsford at speeds corresponding to sixty words per minute and upwards, the words being read like a moving sign on a ground glass screen in the receiver at York. In order to show the transmitting equipment at work local demonstrations illustrating the complete process were also given to several groups of scientists at St. Peter's School.



TELEVISION TRANSMITTER AND SCANNER

Three different types of television receivers which had been installed by the Marconi engineers at York were inspected with particular interest. These were the television "News" receiver with its ground glass screen, 25in. by 3in., for the reception of printed messages; the television "Broadcast" receiver giving a moving picture on a screen 8in. by 8in.; and the television "Projector" receiver, which is capable of throwing a moving picture on to a white screen 4ft. square.

The television signals were received at York by means of a simple type of radio receiver designed to have a very broad frequency response curve. The receiver consists of one stage of high-frequency magnification, anode bend detection and one stage of low-frequency amplification. The output from this receiver was taken to a power amplifier for use on the fifteen-line tape scan "News" receiver. The fifteen-line "News" and fifty-line "Broadcast" receivers make use of a sodium tube of the dumbell type mounted close to an aperture. The modulated light is projected on to a screen by means of a mirror wheel driven by a synchronous motor and giving a horizontal scan. The fifty-line "Projector" makes use of a Kerr cell, but is in other respects similar to the "News" and "Broadcast." The "Projector" and the "Broadcast" give fifteen pictures a second, while the "News" provides twenty.

The "Broadcast" fifty-line transmitter which was in operation at York has been designed to enable television pictures of moderately good definition to be transmitted at the rate of fifteen per second from any high-class broadcast transmitter. It is illustrated by the accompanying engravings.

In addition to the scanning apparatus, photo-electric cell, and amplifier system, circuits are provided :—

(*a*) For maintaining the motor driving the scanning disc at a constant speed.

(*b*) For generating synchronising impulses which are passed to the receiver and there synchronise the receiver motor with the transmitter motor.

(*c*) For "monitoring" the transmitted picture, *i.e.*, checking the type or picture being transmitted.

(*d*) For control purposes.

The scanning machine comprises two Nipkow discs, motors for driving the discs, two projection lenses, and an arc lamp. The transmitting disc proper is constructed of thin aluminium sheet which is punched with fifty square holes 0·45 mm. in size. These holes or apertures are arranged round the disc in the form of a spiral and are spaced at 7·2 deg. apart, each hole differing from the preceding one in radius to the centre of the disc by exactly its own width. The disc is driven directly from an ½ H.P. synchronous motor which is driven from a D.C. supply of 100 volts and maintained at a constant speed by a separate A.C. supply. At right angles to the transmitting disc is a second disc, which is used for the purpose of "monitoring" the transmitted picture. This is driven by a second motor which is kept in strict synchronism with the motor driving the transmitting disc. The arc lamp is "hand fed" and is equipped with a hemispherical reflecting mirror. It is situated directly behind the disc and projects a beam of light on to the top vertical centre of the disc, forming an illuminated area sufficient to embrace 22·5 mm. square, corresponding to a 7·2 deg. arc which forms one picture. The holes in the disc pass through this illuminated area and the light passing through the holes is thrown on a screen through one of the two lenses, the apertures in the disc being focussed on to the subject which is placed in front of the screen and in the light beam. Alternative lenses are provided for use when scanning a full-length figure or when a close-up of a head is being transmitted. The "full-length" lens has a focus of 3½in. with F. 2·75. The "close-up" lens has a focus of 2in. with F. 1·8. The lenses are mounted on arms and are selected by a simple swing-over device. A movable frame is fixed between the disc and the lens for the purpose of adjusting the length of traverse of the light-spot so that the end of one scan is immediately followed by the beginning of another.

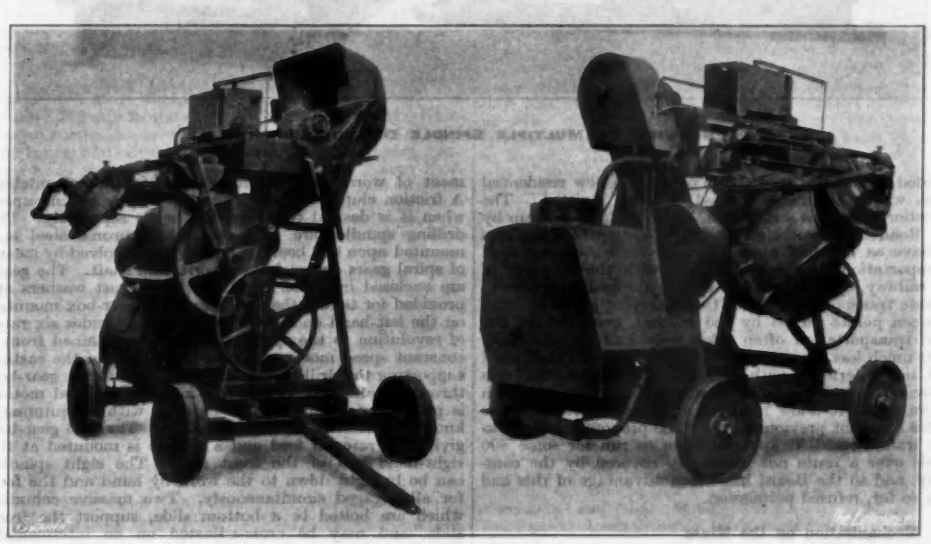
The moniter disc is larger in size than the transmitter disc, the aperture dimension being 0·75 mm. This, being used for the purpose of check reception, is equipped with a neon tube having a flat plate some 4 cm. square, which is placed behind the disc and vertically above the disc spindle. This plate, when luminous, lights up an area of the disc corresponding to one picture area. A viewing lens and holder is mounted in front of the disc for the purpose of magnifying the image and cutting out extraneous light. The line amplifier is a simple resistance capacity coupled unit employing five valves, four of which are in cascade, the last two being paralleled off, one to the line output transformer and the other to the monitoring amplifier. This amplifier has a substantially straight-line frequency characteristic from 50 to 18,000 cycles, the normal fall-in level at 9000 cycles of a resistance capacity coupled amplifier being extended by the use of an air core choke in series with the anode of the first valve. Gain control is supplied for the amplifier as a whole and for the monitoring valve separately.

The monitoring amplifier is used for the purpose of checking the radiated picture against the line picture. The line signal is tapped in the line amplifier and is magnified through three resistance capacity coupled stages to the output valve, which is choke coupled to the neon tube behind the monitoring disc. The amplifier also contains a radio frequency circuit consisting of a band pass filter and anode bend rectifier. A simple switch cuts off the line signal from the first valve grid and connects it to the detector output, by which means the line or radio signal may be observed in the monitor neon tube. The fork amplifier and fork unit consist of an electrically maintained tuning fork and a resistance capacity coupled amplifier. The constant frequency output from this amplifier is fed into the transmitting disc motor and serves to maintain this at a constant speed. The photo cell system consists of a photo cell mounted in a parabolic reflector at the focus, and a small amplifier consisting of one stage of screened grid amplification utilising a type MS4 valve and one stage of triode amplification with an MH4 valve mounted directly behind the photo cell. The synchronising unit is designed to receive impulses generated by the motor driving the transmitting disc, and to amplify them by means of a special circuit in such a manner that a constant amplitude synchronising impulse is inserted in the television signal transmitted to the receiver at the end of each scan line impulse. This synchronising impulse is separated from the television signal at the receiver end and is used to control the speed of the receiver motor.

De-aerated Concrete.

MICROSCOPIC examination of normal concrete reveals the fact that it is filled with minute air bubble cells which render the concrete both weaker and more porous than it otherwise would be. It will be readily appreciated that porosity alone will permit of the reinforcement becoming oxidised, with a corresponding definite loss of strength.

The illustration shows a concrete mixer produced by Marshall and Sons, Ltd., of Gainsborough, in conjunction with the Modern Concrete Development Company, Ltd., in which the concrete is de-aerated. Rigidly supported upon cross members to the upper part of the A frames on the discharge side of a standard tilting drum mixer is fitted a shaft carrying the levers connected with a drum-sealing cap. This cap is fitted with a special "Sorbo" rubber ring, which makes airtight contact with the drum aperture. The cap consists of a steel pressing and is mounted upon a radial ball bearing to ensure perfect alignment with the minimum of friction. As will be seen from the engraving, the movement of the cap is controlled by a lever placed in easy reach of the operator, and is so arranged that a movement in one direction leaves the drum free to tilt, and at the same time cuts off atmosphere from the pump. The exhauster pump is of the rotary type with a non-return valve and silencer. Under normal working conditions this pump will give 26in. of vacuum in as many seconds. When the drum is charged it is tilted back in the normal way to the mixing position, and an opposite movement of the lever drops and couples the cap over the drum direct to the exhauster pump *viâ* a flexible armoured metal air hose. As soon as the air is exhausted, as shown on a gauge under the operator's eye, the vacuum is broken, atmosphere cut off from the pump and the de-aerated mix discharged in the ordinary manner. To ensure a good contact with the sealing cap, the standard drum cone is replaced with a casting and its contact face machined. In other respects the mixer is a standard machine, and in the case of the unit illustrated of 10/7 capacity.



DE-AERATING CONCRETE MIXER

The advantages for de-aerated concrete claimed by the makers can be briefly summarised as follows :—

There is considerable increase in the compressive strength, with elimination of local weaknesses due to badly graded material. The product has considerably greater wearing qualities, particularly in cases such as road surfaces. The thickness of the concrete can be reduced whilst still maintaining a standard specified strength. Owing to the greater strength of de-aerated concrete it is safe to remove shuttering and other supports more quickly, thus enabling the work to proceed at greater speed. The quantity of cement can be reduced without loss of strength. The elimination of cellular voids caused by imprisoned air pockets and bubbles gives a corresponding increase in density. Thus in a 4 : 2 : 1 mixture, of shingle, sand and cement, the original weight of which was 140 lb. per cubic foot, the weight was increased by de-aeration to 148 lb. per cubic foot. De-aerated concrete possesses a high degree of impermeability to water.

The following tests were carried out by Mr. R. H. H. Stanger :—

Compression tests were made on 6in. cubes cast in plain concrete and also in de-aerated concrete. The cubes were made in the proportion of 4 parts Ham River ballast,

2 parts Ham River sand, and 1 part "Ferrocrete" rapid-hardening cement, and the period of crushing was seven days.

Plain concrete.		De-aerated concrete.	
Lb./sq. in.	Tons/sq. ft.	Lb./sq. in.	Tons/sq. ft.
1695 1775 Mean 1835 1768	113·6	3710 4100 Mean 4146 3985	257

The cubes were gauged with 8·65 per cent. of water.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Trade Situation.

In Midland and Staffordshire industries the recent rate of progress was maintained this week, and although September has as yet brought no rush of business, there was increased interest in autumn prospects and in the weekly meeting of the Birmingham iron and steel market. There are signs which point to the development—as is customary at this period—of trade during the remaining months of the year, and it is firmly believed that the autumn of 1932 will not fail to produce more industrial activity than recent predecessors. Although, up to the present, the movement has been but small in the basic trades in this area, in some sections of industry there is already considerably more movement than during the summer months, and each week from now on is expected to witness greater output from Midland and Staffordshire factories. As stocks of raw material at the works are very small, the basic industries will eventually benefit. Indeed, it is noticeable that there are already in circulation a good number of inquiries for material for autumn consumption. True, manufacturers exercise much caution as regards material purchases, and most current specifications relate to iron and steel required for immediate consumption.

Steel.

There is no material alteration in the position in the finished steel trade on the week. There have been a few small constructional jobs which have kept local plant going, but demand from structural and other heavy engineers is still poor. There is a call for special steels such as are required by automobile engineers, but the general slackness at the consuming works is reflected at the steel works, where steel masters are at a loss to make up rolling programmes. Prices are being maintained by the Steel Association, joists being obtainable at £8 15s., less a rebate of £1 2s. 6d. to users of British steel only. Sales of English semi-finished steel are confined to small quantities, and steel makers are more hopeful of retaining orders in this country, since there is a tendency for Continental values to appreciate further. The rise in small bars and soft billets reported last week is accentuated this week. It is unaccompanied, however, by any new activity of demand, and Birmingham importing merchants report poor business. Native producers uphold the recent selling rates. Re-rollers require £6 7s. 6d. upwards for small bars re-rolled from Continental billets, and upwards of £7 for all-British bars. Soft billets are quoted £4 17s. 6d. to £5 7s. 6d., sheet bars £4 15s. upwards. Staffordshire hoops are firm at £9 10s.

Pig Iron.

Recent sales of Midland brands of pig iron encourage the hope that additions to the heavy stocks now held by many blast-furnacemen will shortly cease. In the present state of the market more iron is being made than can be absorbed by local foundries, and stocks are heavy, especially at the furnaces in Northamptonshire. The tone of the market is more enthusiastic, however, as some good inquiries have been received for raw material for autumn consumption. Founders in this area are filling up their order books, and there is more activity at the works than for some time past. Chief movement is in the light castings branch, but engineering foundries are steadily improving their position. Orders are unevenly distributed, and some firms remain quiet. Northamptonshire blast-furnacemen are selling quantities of iron in Northern markets at reduced rates and so keeping stocks from becoming a menace to productive activity. Selling prices of pig iron are as fixed by the Central Pig Iron Producers' Association, Derbyshire foundry material being on the basis of £3 6s. for No. 3, and Northamptonshire on the basis of £3 2s. 6d. for similar grade iron. Forge sorts sell at 5s. per ton below these rates in each instance. Quotations are for delivery to Black Country stations.

Finished Iron.

In the Staffordshire finished iron trade orders are small for all classes of bars and strip, and works are poorly employed, production being about 50 per cent. of capacity. This week has not produced any bulk of orders, and ironmasters view the immediate position with concern. They are not without hope, however, of an early turn of the tide. Prices are unaltered, marked bars being £12 per ton at makers' works, Crown bars £9 upwards, fencing bars £7 15s., nut and bolt bars £8, iron tube strip £10 7s. 6d. to £10 10s. delivered. Belgian iron continues to compete successfully in the common bar market.

Galvanised Sheet Prices.

The advance of spelter and some seasonal strengthening of demand for sheets has brought additional strength to the galvanised sheet market, and quotations have advanced to the basis of £9 5s. per ton for 24 gauge corrugateds. It is still possible to get good export orders accepted at £9 2s. 6d., but the number of local mills prepared to do business at this figure is small. Where there is a considerable shortage of work, however, suppliers are tempted to accept the lower price as a means of keeping plant more regularly engaged. The general position of the industry shows improvement. Inquiries and orders from overseas are slightly more numerous, while home demand should be stimulated further as the harvest advances. Black sheets are in fair request, but there is reported to have been a slight decline in the demand from automobile engineers during the past week. This, it is believed, will be but temporary. Selling prices in this department show no change.

Copper and Brass.

Strong copper sheets have been advanced £3, the district price as quoted at Birmingham now being £68 per ton. Rolled brass has been raised ¼d. per pound, making it 7¼d. There is no change in tube prices, which are 9d. for solid drawn brass, 10d. solid-drawn copper, and 11d. brazed brass.

Engineering Apprenticeship Certificate.

The scheme of the Engineering and Allied Employers' Association and the Birmingham Education Authority for the provision of a new form of certificate for young engineers, particulars of which have been previously given in THE ENGINEER, came into operation on the first of this month. It will be recalled that the scheme is designed to encourage apprenticeship by the presentation to suitably qualified apprentices of a certificate to be known as the City of Birmingham Apprenticeship Certificate. The certificate is not limited to indentured apprentices, but will only be awarded to those who are not less than twenty-one years of age and are recommended by their employers and have had works' experience, constituting a training appropriate to the trades in which they seek employment. Apprenticeships of less than five years' duration will only be considered in those cases where they have been preceded by a secondary, public school, or full-time technical education up to the age of admission. At least 60 per cent. of the apprenticeship period must have been spent in the shops as distinct from the drawing-office or other offices. The attainment of an approved minimum standard of technical education certified by the Birmingham Education Authority is essential. Such a standard is that of the National Certificate in Mechanical or Electrical Engineering (ordinary grade), or an appropriate City and Guilds Certificate, or a Trade Science Certificate awarded on a course for the technical instruction of trade apprentices who are not otherwise suitably provided for by existing examinations. The scheme is essentially local, although it has a national aspect in the sense that if other centres of the engineering industry follow a similar plan it will become national in its scope. Coventry is already operating a scheme on similar lines. The certificate is within reach of all apprentices who are still serving their time and whose training and technical education are of a kind that will enable them to qualify for the award.

Indian Engineers' Union.

Indian engineers practising in Great Britain decided at a recent meeting in Birmingham to establish an Indian Engineers' Union of Great Britain. The objects of the Union are to voice the opinion of Indian engineers on subjects of vital importance in the industrial development of India, to promote and safeguard industrial interests to the mutual benefit of India and foreign countries, and to promote and protect the interests of Indian engineering students. A statistical and general information committee has been appointed to investigate the growth of various industries and the possibilities of their development in India on similar lines, and a technical committee to collect and supply technical data in respect of particular industries and also information regarding raw materials. Dr. K. M. Pardhy, of Birmingham, was appointed the first President. Mr. A. K. Bhaumik, B.Sc. (Eng.), of Manchester, is the general secretary, and Mr. B. B. Moonje, of Birmingham, publicity secretary.

Rail Screw Order.

In my letter last week I made brief mention of a large railway order which has recently been placed with Bayliss, Jones and Bayliss, Ltd., of Wolverhampton. I am now able to give some details of the contract. It consists of 1,500,000 rail screws for the South African Railways, which will require at least 1000 tons of steel bars for their manufacture. The whole of this order is guaranteed under penalty for delivery in six weeks' time. During this period it is anticipated that employment will be found for at fewest sixty men and women who at present are suspended owing to scarcity of orders. It is of interest to note that during the past ten years Bayliss, Jones and Bayliss, Ltd., who claim to have the most modern screw-making plant in the world, have manufactured 30,000 tons of railway fastenings for the South African railways.

Cheaper Screws.

In view of the decision of the Import Duties Advisory Committee further to protect the wood screw industry, Guest, Keen and Nettlefolds, of Birmingham, on Tuesday, announced a reduction in the price of iron and brass wood screws. This reduction is made in anticipation of an increased demand for the company's products and a consequent reduction in production costs.

Oil from Coal.

Midland coalowners and engineers are interested in the report that Lady Houston has agreed to share with Sir Eric Hambro the financial responsibility of testing commercially Commendator Piero Salerni's process of low-temperature carbonisation of coal—the production of a hard smokeless fuel, together with a high yield of by-products, such as fuel oil, motor spirit, dyestuffs, explosives, and artificial fertilisers. Report is current that the factory will probably be located in the Midlands, though I understand this has not yet been determined upon. This district, however, has the essential factors for such a factory, being a coal-producing area with excellent transportation facilities, and it is believed that it will eventually be chosen for the venture.

Cannock Chase Coal Output.

Cannock Chase coalfield output during 1931 was 4,724,832 tons, this being a considerable decline from the tonnage raised in previous years. In the past the output has reached as high a figure as 6,000,000 tons in a year, but the prolonged slump in the industry has had a serious effect. The fact, however, that the pits are working about 100 days a year less than formerly indicates that the average daily output of the local mines has gone up as a result of the growing use of machines in coal-getting.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

The Export Credits Grievance.

MACHINE tool makers and other Lancashire engineering concerns continue to take an active part in the campaign to secure the grant of extended facilities by the Government Export Credits Guarantee Department, in connection with Russian business, and there is a growing hope that, with the backing of the Federation of British Industries, some measure of success will be achieved. During the past week there has been discussion of the question of extending the export credit facilities to the shipbuilding and allied industries in connection, more particularly, with the construction of vessels of special types for use in Russian waters, ice-breakers, tugs, dredgers, and river ships being among the classes specified. Engineers in the Manchester district, whilst being little interested in shipbuilding *qua* shipbuilding, have a very direct interest in the manufacture and supply of auxiliary appliances and fittings, electrical machinery, pumps and fans, motors, cables, Diesel engines, and valves figuring largely among the engineering products of Lancashire. Obviously, there is here a field for enterprise which, granted the necessary credit facilities, should benefit the shipbuilding and allied industries without necessarily having any harmful reaction upon the British shipping industry itself.

Conquering New Fields.

The success of a new departure was indicated at the annual meeting of Arundel, Coulthard and Co., Ltd., textile machinery makers, of Stockport and Preston. In consequence of the depression in the textile machinery industry, the company launched out into the manufacture of lawn mowers, and the chairman, Mr. J. Higginson, told the shareholders that the sales during the year were on a larger scale than in the previous season and that during the coming season a still larger demand was expected. Incidentally, Mr. Higginson expressed the opinion that the worst of the depression in the textile trade had been seen and that there would be a distinct improvement in the near future. Mr. H. Arundel, another director, thought there were certainly distinct signs of improvement in the coming year.

Another example of Lancashire enterprise arose out of the joint factors of the departure from the gold standard a year ago, and the imposition of a general tariff early this year. Swiss machinery for the manufacture of braid and elastic was imported by a Manchester firm, Crowther, Ltd., which took immediate steps to secure the right to manufacture under licence in this country. It is claimed that both from the point of view of efficiency and production costs the venture has proved to be a success. A large order for the Australian market has just been completed, and work is in progress on other machines for the same market.

Non-ferrous Metals.

There has been further ample evidence during the past week that the upward movement in the non-ferrous metals market has not yet run its course, for in all sections current quotations are substantially higher than they were a week ago, with the advance the most pronounced relatively in the case of spelter. The result has been a largely increased turnover during the week in all the metals, with copper easily leading the way. As usual, of course, speculative activity has been responsible for an appreciable proportion of the tonnage changing hands, but there is evidence that a good many consumers have now seen fit to enter the market on an important scale and forward buying interest from the industrial side has widened. Standard brands of copper have moved up on balance for the week to the extent of rather more than £2 per ton, with prices of the refined grades correspondingly dearer. Tin has advanced by about £7 10s. per ton, notwithstanding a reactionary tendency noticeable at times, and the week's rise has brought this metal to well above the £150 mark. It is not unlikely that at this price a proportion of the stocks under the control of the Producers' Association will be released. Lead is roughly £1 per ton dearer on balance, whilst in spelter the rise has been of the order of £1 15s.

Iron and Steel.

Largely in consequence of the Lancashire cotton trade dispute, although other influences continue to play a part, it is not possible to report any improvement in the iron and steel trades in this area. The superabundance of scrap rather than any further actual contraction at the consuming end is responsible for aggregate deliveries of foundry iron into consumption locally being smaller than they should be even at this time of the year. So far as new business is concerned, the orders placed during the past week have been for small quantities, with deliveries in most instances extending not very far ahead. Forward contract business has been virtually at a standstill. There

has been no change in the price position, however, quotations for delivery to works in the Manchester district being on the basis of 67s. per ton for Staffordshire, Derbyshire, and Cleveland No. 3 iron, 65s. 6d. for Northamptonshire, 62s. for Derbyshire forge, about 85s. for Scottish foundry, 81s. for West Coast hematite, and from 67s. to 75s. per ton, according to brand, for Indian iron. The bar iron trade is of a retail character, with Lancashire Crown bars still quoted at £9 15s. per ton and best quality bars at £10 5s. Conditions are still inactive in the steel trade, especially in constructional engineering, boilermaking and locomotive building, all of which are circulating delivery specifications to the mills on a disappointing scale. Alloy steels, also, are meeting with a quiet demand at the moment, although in this branch hopes of improvement towards the end of the month seem to be fairly strong. Small re-rolled bars are quoted at from £6 15s. to £7 per ton, boiler plates at about £8 10s., sections at £8 7s. 6d., joists at £8 15s., tank plates at £8 17s. 6d., and large-diameter bars at £9 7s. 6d.

BARROW-IN-FURNESS.

Hematites.

The condition of the hematite pig iron trade of the area is still very unsatisfactory. Production is at a low level, but all wants can be covered and there are quite heavy stocks of iron to fall back upon. Locally there is still no call for iron and little is doing on Continental account. Trading generally is from hand to mouth and there are no signs of any improvement.

Iron Ore.

The demand for hematite iron ore is quiet and is mostly confined to local smelters. The outside demand is small. Importations of foreign ore are easy.

Steel.

There is a better position to report in the steel trade at Barrow. After being idle for many weeks the steel plant was put into operation on Tuesday in the rail and other departments. The agreement as between the Barrow Steel Company and the L.M.S. Railway Company with regard to the closing of the Crewe Steel Works will represent the rolling of rails for that railway for the next ten years. The United Steel Company, of Workington, will also benefit. There is a steady demand for hoops.

Shipbuilding.

With the placing of the order for a British cruiser with Vickers-Armstrongs, Ltd., work will be forthcoming at the Barrow shipyard. The keel of this cruiser will be laid about the end of November.

SHEFFIELD.

(From our own Correspondent.)

The Heavy Steel Trades.

CONDITIONS on the heavy side of the local steel industry show little change. Production of open-hearth steel continues on about the same moderate level as recently reported, and there is an absence of bulk business and of orders for forward delivery. A brighter prospect for armament and shipbuilding work is opened up by the placing of Admiralty orders. Vickers-Armstrongs having received the contract for the hull and machinery of the cruiser "Ajax," of 7000 tons, some of the work in connection with it will come to Sheffield. Orders have yet to be placed for the construction in private yards of eight destroyers and other vessels, and they also should benefit the local trade. Orders for shipbuilding steel on mercantile account are still very scarce, and there is little doing in railway requisites. It is announced that the Barrow Hematite Steel Company, Ltd., has concluded a contract for the purchase of the goodwill of the L.M.S. Steel Works at Crewe, in which it invited the United Steel Companies to participate, and that, under this arrangement, the greater portion of the steel materials rolled by the railway company at Crewe will, for the next ten years, be rolled by the Barrow and United Steel Companies.

In Lincolnshire.

Full time is now being run in the melting department of the Normanby Park Steel Works, which are the largest in North Lincolnshire. At the Appleby Works there is less activity than of late. They are melting the steel used by the neighbouring Frodingham Works, whose melting furnaces were closed about a year ago. There is no further news as to the re-starting of the Redbourne Hill Works, although it was announced a good while ago that this would be done should the tariff on foreign steel be made permanent.

A Smokeless Furnace.

The chairman of the Brightside Foundry and Engineering Company, Ltd., announces that, in connection with the company's heating and ventilating department, it has developed and put on the market on May 20th, 1932, a patent furnace for steam boilers which it believes is as nearly smokeless as is practically possible. It is simple in design and made almost entirely of cast iron, and is just the kind of work wanted for the company's shops. Experiments and tests show that it will effectively burn the lowest-grade fuels, even the slurry from coal washery plants, and several furnaces are already installed and giving complete satisfaction.

Rolling Mill Plants.

The company has at present on its books orders for two large non-ferrous rolling mill plants, one of which is of a type that has not hitherto been manufactured in this country. Arrangements have been made to co-operate with the firm of August Schmitz to manufacture some of its cold rolling machinery in Britain. This type of machinery has previously been manufactured on only a small scale in this country, but confidence is expressed that it has a wide application in the ferrous and non-ferrous industries. The Brightside Company is at the moment better off in the rolling mill engineering side of its business than it has been of late, although the chairman points out that prices are such that it is impossible to obtain even a small margin of profit, and the work will only help in that some portion of the overhead charges have been covered. Although the foundries are particularly slack, owing to the abnormal position in the heavy trades, the company has spent a considerable sum of money on the reconstruction of its melting equipment and the installation of a new type of furnace which, it is convinced, will enable it to produce a higher quality and specialised type of roll, together with a specially refined iron for the trade. The clay-working machinery department is also very slack, but there are several nice inquiries about.

An Order for Stoves.

A useful amount of work will come to Sheffield as the result of an order which Mr. Hamer Russell, M.P. for the Brightside Division, has secured in connection with a large housing scheme promoted by the Manchester Corporation. The order embraces 1764 back-to-back grates and combination ranges, and 3028 bedroom fire-grates. Mr. Russell is head of the firm of Hamer Russell, Ltd., builders' and plumbers' merchants, of Sheffield. The goods to be supplied under this contract will be manufactured at the Harleston Ironworks of Moorwoods, Ltd., Sheffield, which will be on full time for five or six months and will need additional hands. The work will represent about £8000 in wages.

The Lighter Trades.

The demand from the automobile makers for pressings, stampings, and special steel keeps up to a good level, although hardly equal to recent averages. Trade in stainless steel and kindred materials is well maintained, and this continues to be one of the most flourishing branches of local industry. Cold-rolled strip and best wire are in good request. The home demand for tools has been poor for some time. The worst lines being tools used in shipyards, quarries, outdoor work, and heavy engineering and foundry operations. There is only moderate employment in the building tools trade. Makers of farm and garden tools have had but a poor season, but as the distributors have sold rather more than they did last year their requirements for next season should be larger. The export side of the tools trade is rather more satisfactory. There have recently been several substantial orders from foreign and Dominion sources, and prospects of more business are considered favourable.

Good News for Scissors Makers.

The news that the Tariff Advisory Committee has imposed new and higher duties on scissors is very welcome in Sheffield, where the progress in this branch of trade, which followed the operation of the 50 per cent. duty under the Abnormal Importations Act, has been checked since the duty was reduced to 20 per cent. The effect of the new duty will be most apparent in the cheaper classes of scissors. The old rate of 20 per cent. was negligible on a pair of small common quality scissors imported wholesale at from 3d. to 6d., but the imposition of a duty of 2s. per dozen pairs is equivalent to a substantial tariff. The Sheffield trade now enjoys a very useful protection against foreign scissors, stabilised for five years. There has been one immediate result of the application of the new duty, in an order for 5000 pairs of scissors booked this week by Messr. Champion and Co., of Broad-lane, Sheffield. When the firm quoted for the scissors some time ago it received an intimation from the firm intending to place the order that the estimate did not interest it, as it had an offer of 5s. 6d. per dozen from Germany. The new duty has changed the situation, and the order has been placed by telegram.

Australian Embargo Lifted.

Exports of Sheffield goods to Australia have shown an increasing tendency for several months, and the electro-plate industry is looking forward to the recovery of a substantial amount of trade as the result of the removal of the Commonwealth embargo upon the importation of electro and silver-plated hollow-ware. Since March, 1931, when the prohibition came into force, the city's previous large trade with Australia in tea and coffee sets, *entrée* and soup dishes, cake baskets, sugar basins, cruet sets, silver and plated bowls, &c., has been at a complete standstill. Australia was Sheffield's largest oversea customer for such goods, and took very large quantities considering the comparatively small population. The embargo has been lifted as the result of a series of conversations between representatives of the two countries at Ottawa. In these, Mr. A. J. Grant, of Sheffield, head of this country's iron and steel delegation, played a leading part and he has received the special thanks of the Master Silversmiths' Association for his services. A gradual recovery of the trade is considered certain.

The Cutlers' Company.

The new Master Cutler of Sheffield, who was elected last week, is Lieut.-Col. A. N. Lee, a director of Walker and Hall, Ltd., silversmiths, cutlery and electro-plate manufacturers. He has had an interesting career. A native of Nottingham, where he was born in 1877, he was a solicitor in that city from 1903 until the war. As an officer of the Sherwood Foresters, he saw severe street fighting in the Dublin rebellion of April, 1916, and subsequently he was a staff officer in France, rising to the rank of G.S.O.1 at General Headquarters. He is a D.S.O. and an O.B.E., and holds many war distinctions from other countries. The new Senior Warden of the Company is Mr. C. J. Walsh, managing director of Ibbotson Bros. and Co., Ltd., Globe Steel Works, with whom he has been connected over twenty years. He is also chairman of the New Conveyor Company, Ltd., Smethwick, and connected with several other industrial concerns. The new Junior Warden is Mr. Alexander Williamson, managing director of the Steel, Peech, and Tozer branch of United Steel Companies, Ltd., and formerly in control of the Vickers works of the English Steel Corporation.

A Change in Management.

Mr. F. C. Fairholme, one of the best-known figures in Sheffield industry, has ceased to be a managing director of the firm of Thos. Firth and John Brown, Ltd., which position he has held jointly with Mr. A. J. Grant since the merger transaction of last year. Mr. Fairholme has been associated with the firm of Firth for nearly a quarter of a century, and was previously a joint managing director of Cammell Laird and Co., Ltd. He has been particularly identified with the development of stainless steel and is chairman of the Firth-Brearley Stainless Steel Syndicate, Ltd. He is a Vice-President of the Federation of British Industries, and Chairman of its Sheffield district branch. He is also President of the Sheffield and District Engineering Employers' Association, and deputy chairman of Davy Bros., Ltd.

NORTH OF ENGLAND.

(From our own Correspondent.)

A Brighter Outlook.

THE industrial outlook in the North of England has brightened considerably during the past few days. It seems clear that optimism is broadening, and there is a general feeling that the present movement has a more durable appearance than any of its predecessors in the past year or two. An encouraging feature of the iron and steel trade is the fading disinclination of customers to negotiate for forward supplies. Buyers are more in evidence than for a long time past, and are becoming less persistent in their efforts to secure price concessions. The improvement in the industry is reflected in the exports from the Tees for the month of August, the overseas shipments of steel for the month being the heaviest recorded this year. A buying movement has set in, and this has stimulated hopes of a marked autumn recovery in the staple trade of the district. Moreover, two additional blast-furnaces have been put into operation, and manufacturers are hoping not only to find more regular employment for plant now running, but also to resume work at some of the mills now idle. The aggregate tonnage of iron and steel shipped from the Tees in August was 35,392 tons, compared with 35,991 tons in July. This total is gratifying in view of the holiday interruptions. Both coastwise and foreign shipments of pig iron showed a slight increase, but the aggregate was only 7296 tons, compared with 6388 tons in July, and it is already certain that September will record a further advance. Principally owing to the holidays manufactured iron and steel shipped coastwise fell from 13,895 tons in July to 9020 tons in August, but foreign shipments advanced from 15,708 tons to 19,076 tons, and it is interesting to note that the increase was entirely due to improved trade with the Soviet, the month's deliveries to Russia totalling 8230 tons.

Imports Down.

Imports of iron and steel into the Tees during August were lower than for several months past. During the month 5162 tons were brought into the river, as against 5940 tons in July, and 16,749 tons in August last year. During the ten months from November last to August 112,553 tons of iron and steel were imported, compared with 141,182 tons during the corresponding period up to August last year. Pig iron imports were again well down, 781 tons being brought into the river during the month compared with 1072 tons in July, and 2294 tons in August last year. During the ten months ended August 9340 tons were imported, compared with 23,419 tons during the corresponding period of last year. Included in this figure of 9340 tons were 8635 tons imported coastwise.

Ironworks Restarted.

The Ayresome Ironworks, Middlesbrough (Gjers Mills and Co., Ltd.), which have been laid idle for several months owing to the depression in the iron trade, were restarted this week. Two blast-furnaces have been put into operation on the production of hematite pig iron, and employment found for about 500 men.

Cleveland Iron Trade.

The improvement in the general tone of the Cleveland pig iron market has become more pronounced. Inquiries circulating are more numerous than for a considerable time, actual transactions are expanding, and recent events encourage hope that the long depression is now passing, and that movement in the direction of gradual trade recovery has begun. Buyers are no longer reluctant to negotiate for forward supplies, and a few contracts for deliveries over the next three months are reported. The statistical state of the industry is unsatisfactory and embarrassing, but prospect of steady increase of demand encourages hope that some reduction in the heavy stocks may occur shortly. Overseas inquiries for pig iron continue light, but are improving. Local consumption promises to be larger, and further sales to home users at a distance are looked for. Prices are firmly maintained, No. 1 Cleveland foundry iron being 61s., No. 3 G.M.B. 58s. 6d., No. 4 foundry 57s. 6d., and No. 4 forge 57s.

Hematite Pig Iron.

Values of East Coast hematite pig iron are steady, and rather inclined to firmness, despite the preparation for enlargement of make. Ordinary qualities are 60s., and No. 1 grade 60s. 6d. Merchants have rather considerable holdings, but are not cutting prices.

Ironmaking Materials.

Business in foreign ore has not yet been resumed. Consumers are well placed as regards supplies, and in no hurry to enter into new contracts. The nominal price

of best Rubio remains at 14s. 6d. c.i.f. Tees. Blast-furnace coke is plentiful, and slow of sale, local consumers still having considerable quantities of their own makes to draw upon. Good medium kinds are quoted at 14s. 6d. delivered at the works in this area.

Manufactured Iron and Steel.

Expansion of transactions in several descriptions of finished iron and steel is reported, and inquiries circulating inspire the hope that the situation will shortly justify the restarting of more producing plant. Galvanised sheet makers, while keenly seeking orders, have had to advance prices owing to increased cost of production due to dearer spelter. Galvanised corrugated sheets, 24 gauge, are now £9 7s. 6d.

The Coal Trade.

Severe restrictions abroad on imports are limiting the volume of business in the Northern coal trade, but there is more moving of a seasonal kind on home account. In the main, however, conditions are quiet, and collieries are hoping to avoid more lost time. It seems inevitable, however, in Durham, as several classes of fuel are having a quiet time. An encouraging feature this week is the placing by the Malmo Gasworks authorities with Newcastle merchants of a contract for the supply of 17,000 tons of prime gas or coking unscreened coal, 3000 tons of which are for shipment this year, and 14,000 tons for delivery over next year. Prices are not divulged, but are understood to be on the basis of the current fixed minimum f.o.b. price. There is a better inquiry in the Northumberland steam coal section, and for the second half of the month supplies are being steadily earmarked, the general tendency being more favourable, so that although stocks offer freely sellers are quoting more steadily. Best large are at 13s. 6d., with small firm at 8s. 6d. Wear prime large are also firm at 15s. to 15s. 1½d., and small at 11s. to 11s. 1½d. Tyne primes are quietly steady at 12s. 9d., small being 9s. Ample stocks of all grades of Durham coal are available, the tendency remaining in buyers' favour. Output is being carefully restricted to prevent dumping on the ground. Best gas coal is quoted at 14s. 6d., and secondary qualities 13s. to 13s. 6d. Coking coal is in moderate request, but there is no lack of supply at 12s. 6d. to 13s. 3d. Unscreened bunkers are easy, with sellers eager to clear their commitments. Best descriptions are 13s. 6d. to 13s. 9d., and secondaries 13s. to 13s. 3d. A satisfactory position prevails so far as gas and patent foundry cokes are concerned. Supplies of gas coke are well booked up over the winter and the price is firm at 17s. 6d. Patent foundry cokes are considerably firmer, both for prompt and forward, and the ordinary classes are now obtaining 14s. 3d. to 14s. 9d.

SCOTLAND.

(From our own Correspondent.)

Shipbuilding.

THE month of August has been a barren one so far as the launching of new craft is concerned, while the only order booked during the month was for a small coaster. The outlook has become brighter in view of orders placed last week and the possibility of further contracts for the Government and private ownership. The order for the machinery for H.M.S. "Amphion" will be welcomed at Dalmuir, as will also the contract secured by Barclay, Curle and Co., Ltd., at Whiteinch. The latter, which is an order for a passenger and cargo motor ship for Burns, Philp and Co., Ltd., Sydney, is only the second contract to be secured on the north side of the Clyde this year to date. The machinery for this vessel is to be constructed by John G. Kincaid and Co., Ltd., so both Greenock and Whiteinch will benefit from this order. Clyde establishments also hope to secure a fair proportion of the work entailed under the naval programme and orders for one or two motor ships in the near future.

New Graving Dock.

Barclay, Curle and Co.'s new graving dock at Elderslie is being rapidly completed and may be ready for use before the end of this year.

Steel and Iron.

Inquiries for steel on export account show a tendency to improve, and it is expected that activities will develop during the autumn months. The works engaged on heavy steel are still short of specifications on home account, especially, of course, for shipbuilding materials. Galvanised sheets are not doing much, but black descriptions have a fair home trade and an improving export inquiry. Tubes are not very brisk at present. Bar iron and re-rolled steel bars are slow to improve owing to the limited buying capacity of consumers. Prices are unchanged generally, with re-rolled steel bars quoted £6 10s. home and £6 5s. per ton export. The scrap market is slightly easier, with heavy steel quoted 35s. and cast iron machinery 44s. 6d. per ton.

Pig Iron.

The turnover in pig iron continues on a comparatively small scale owing to limited demands and continued importations of Indian iron and smaller lots from England. There is only one furnace in operation at present. The recent reduction of 1s. per ton in hematite has not improved the demand so far. During the past week about 800 tons of pig iron arrived from Barrow and Millom.

Coal.

In all branches of the Scottish coal market business continues quiet and there are no immediate prospects of improvement. The consumption on home account is still under normal, and although outputs have been reduced considerably the quantities thrown on the shipping market have been excessive. Consequently with an abundance of large fuel available the collieries experience difficulty in maintaining prices. With the exception of best Fifeshire, all round fuels are plentiful for prompt shipment; in fact, considerable quantities of Lanarkshire fuel have accumulated at the sidings. On the other hand, washed nuts, especially trebles and doubles, maintain their recent firmness. Aggregate shipments amounted to 223,245 tons, against 224,401 in the preceding week and 199,066 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

The Coal Trade.

IT is very difficult to get away from facts when endeavouring to preserve a hopeful view regarding the steam coal trade of this district, because the conditions of late have been anything but satisfactory. It is true that towards the end of last week the position was worsened by bad weather delaying the arrival of tonnage, but apart from that there is no doubt that the current demand, both last week and this week, has been disappointing. Taking the ports in this area at which steam coals are mainly shipped, the returns at the end of last week showed that only about 25 per cent. of the berths were occupied. Between the ports of Newport and Port Talbot there were fifty-four idle tips, while at Swansea, where anthracite is principally loaded, one berth was vacant and there was one steamer waiting. Returns issued by the Great Western Railway Company for the docks in which it is interested show that shipments of coal of all descriptions and coke last week amounted to 328,815 tons, as compared with 337,040 tons for the preceding week and with 384,189 tons for the corresponding period of last year. Loading operations should show some improvement in view of the fact that chartering of tonnage of late has been slightly more active, but at the same time this week did not start too well, as on Monday the dock returns revealed that thirty-three tips were idle, three of these being at Swansea. Apart from a contract being secured for the supply of about 10,000 tons of coals for Portuguese trawlers, no new business of any real account has of late been arranged. A few small shipments have been made to the Irish Free State for railway purposes, but it has to be admitted that during the past week or so operations have been more active in the chartering of tonnage to load German and Polish coals for Ireland. So far as our coal trade relations with Belgium and Germany are concerned there has been no development.

Coals for France.

Considerable interest was manifest in local coal export circles at the end of last week by the report of the speech made by Monsieur Leon Meyer, the French Minister of Mercantile Marine, to a deputation of French shipowners at Cherbourg. The complaint was made that four-fifths of the coal imported into France was carried by foreign tonnage, while a quarter of a million tons of French colliers were laid up. The Minister pointed out that they could not compel coal importers to ship all their coal in French bottoms, but he nevertheless intended to issue a decree by which import licences would only be granted on condition that 50 per cent. of the coal should be shipped under the French flag. This measure is to come into operation on October 1st. Following upon this news, further information came to hand, though it should be pointed out that it has not reached this side in an official way, that the French project is to increase the import quota for British coals by 100,000 tons monthly on condition that French importers undertake that 200,000 tons of the total monthly coal imports are carried in French tonnage. As South Wales supplies France with rather more than half of the quantity exported by this country to France, it follows that there is the expectation that South Wales will benefit to the extent of an additional 50,000 tons monthly. These additional shipments will, of course, be very welcome, but exporters are disposed to exercise a certain amount of caution in looking forward to this extra business pending the receipt of official news on the point. The fact is that reports have from time to time in the past been received of French proposals to restrict the carriage of imported coals to French tonnage, but nothing has materialised. It is not such an easy matter to put into operation, and it might be added that complications would certainly follow if this country said that pitwood required for the collieries shall only be brought over from France by British-owned steamers. The French Government must realise that reprisals are possible if they overstep the mark in the matter of stipulations as to what tonnage shall be employed to carry coals to France. It is, however, well known that over 50 per cent. of the tonnage engaged in the transport of coals from South Wales is foreign owned, and the probability is that so far as British owners are concerned they are not likely to be unduly perturbed by the action now proposed by the French Minister of Mercantile Marine, for it is well known that French shipowners do not own suitable tonnage in anything like a sufficient quantity to meet the trade of the North French ports, and the same applies perhaps in a lesser degree to the trade that is done for the French Bay ports, so that any drastic measure decided upon by the authorities may very easily cause a great deal of trouble for the French coal importers and consumers and increase the cost of their coal supplies. Until, however, more official details are to hand as to the exact scheme of the French authorities it is impossible to form a definite opinion as to its effect.

Coal Trade Audit.

The report of the joint accountants of the South Wales coalfield for the three months ended July 31st shows a slight increase in the average pithead proceeds per ton, but an increase in the total cost of production, compared with the previous three months, with the result that there was a debit balance of 2·17d. per ton, representing a total sum of £76,482, as against a credit balance of 2·49d. per ton, or £91,554, in the preceding three months. The percentage certified on the 1915 standard rates was minus 0·86 per cent. Under the wages agreement, however, the miners are entitled to a minimum of 20 per cent. above the 1915 standard rates, and accordingly the colliery owners are called upon to finance the whole of the difference between the certified economic percentage of minus 0·86 per cent. and the actual 20 per cent. minimum. The output in the three months ended July was 9,130,400 tons, compared with 9,543,100 tons in the preceding quarter and with 10,020,632 tons for the corresponding period of last year. It may be added that the quarterly average for 1913 was 14,200,000 tons.

Welsh Iron Ore.

The executive of the South Wales Miners' Federation had under consideration on Thursday last week a communication from the Pontypridd district, in which a complaint was made against the dumping of foreign ore in this district and a plea for the compulsory use of a quota of native ore. The miners' agent stated that he was acting on behalf of the employers and employees of the Llanharry iron ore mines in Glamorganshire, where there was an inexhaustible supply of iron ore. It was further contended that in quality the ore compared favourably with foreign ore, and the Federation was asked to use its influence with the Government with a view of securing the compulsory consumption of a prescribed quota of native ore by South Wales blast-furnaces. The Executive Council decided to defer further consideration of the subject until additional details had been obtained.

Current Business.

Day-to-day operations are on a very narrow scale in steam coals, the steadiest section of which is that for dry sized descriptions. These qualities are very scarce, but large steam coals are excessive and numerous collieries have been idle of late. Patent fuel is fairly well placed and coke moves off rather more freely. Pitwood is easier owing to supplies being more plentiful. Portuguese wood is obtainable at 20s., but French supplies of half-and-half range up to 23s., according to the port of discharge.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

MR. A. REAME, A.M.I.E.E., for many years with Clayton and Shuttleworth, Ltd., and Babcock and Wilcox, Ltd. (Lincoln branch), has commenced practising as a consulting engineer at Monson Chambers, Corporation-street, Lincoln.

MR. G. N. GUEST, lately managing director of Hollings and Guest, Ltd., and of John Hands and Sons, Ltd., has joined Tangyes Ltd. Inquiries for hydraulic machinery or power presses will be attended to under Mr. Guest's supervision.

WOLF AND WILLIAMS, 53, Victoria-street, S.W.1 ('phone, Victoria 6051), inform us that they have been appointed sales representative for England and Wales for Croydon Engineering Company, Ltd., designers and manufacturers of fractional horse-power motors.

MR. PERCY LISTER, managing director of R. A. Lister and Co., Ltd., of Dursley (Glos.), has been appointed by Mr. Isaac Foot, M.P., Secretary for Mines, to be one of the representatives of coal consumers on the Committee of Investigation for the Forest of Dean district.

MR. S. PELL-ILDERTON announces that A. C. Wells and Co., Ltd., will be definitely carried on by him as receiver and manager. All correspondence will be dealt with, either at the head office, 43, Carnarvon-street, Cheetham, Manchester, or at 82, Victoria-street, S.W.1.

LEYLAND MOTORS, Ltd., have placed a contract for the erection of new and larger premises in Wakefield-street, Wellington, New Zealand. The whole of the two-story structure, to be known as Leyland House, will, so far as is possible, be constructed of materials which are of British origin. The frontage of the building will consist of showrooms and offices, whilst at the rear will be workshops of the most modern type. A separate building at the rear of the premises will be devoted to a large bond store

PERRIN'S, Ltd., of 3, Central-buildings, Westminster, S.W.1, ask us to announce that Major K. G. Stacy Hatfield, A.M.I. Mech. E., has joined the board of the company, which now consists of three members. Mr. Michael Perrin, M.C., B.A., A.M. Inst. C.E., A.M.I. Mech. E., remains the chairman of the company, and the third member of the board is Mr. C. J. Comins, A.C.A., whose firm, Charles Comins and Co., of 50, Cannon-street, E.C.4, has for many years acted as the company's auditors.

CONTRACTS.

BLACKSTONE AND CO., Ltd., of Stamford, Lincs., have received an order for the supply of sludge-pumping equipment for the Gravesend sewage disposal works.

THE LEAMINGTON CORPORATION has awarded the contract for 33in., 30in. and 24in. watertight tidal valves to the Ismailia Valve Company, of 17, Victoria-street, Westminster, S.W.1.

GUY MOTORS, Ltd., Wolverhampton, inform us that H.M. War Office has just placed with them a large contract for 3/5-ton rigid six-wheelers. This is the largest contract ever placed with the firm by the Government.

SIR WILLIAM ARROL AND CO., Ltd., have obtained from the London and North-Eastern Railway Company the order for two 50-tons, four-motor overhead electric travelling cranes for the erecting shop at the Cowlairs Works, Glasgow.

BLACKSTONE AND CO., Ltd., Stamford, have received an order for the supply of sludge pumping equipment for the Gravesend sewage disposal works. The order includes eleven sets of electrically driven "Blackstone" Unchokeable sludge pumps, controlled by both automatic and hand-operated starters. The whole contract, which includes the supply and fixing of pipes, valves, and wiring complete, is valued at approximately £3500.

LAUNCHES AND TRIAL TRIPS.

CORABANK, motor oil tank vessel; built by Workman, Clark (1928), Ltd., to the order of Messrs. Andrew Weir and Co., for Bank Line Service; dimensions, 495ft., 63ft. 9in., 35ft. 6in.; to carry oil in bulk. Engines, oil, Workman Clark-Sulzer type; constructed by the builders. Trial trip, August 24th.

DANUM, sailing barge; built by Richard Dunston, Ltd., Thorne, near Doncaster, to the order of Thomas Hanley and Sons, Ltd., Doncaster; to carry grain; launch, August 31st.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	16/6 to 20/–
(1) Spanish	17/– to 22/6
N.E. COAST—	
Native	18/– to 21/–
Foreign (c.i.f.)	14/6

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 7 6	—
No. 1 Foundry	3 12 0	—
No. 3 Foundry	3 9 6	—
N.E. COAST—		
Hematite Mixed Nos.	3 0 0	3 0 0
No. 1	3 0 6	3 0 6
Cleveland—		
No. 1	3 1 0	3 1 0
Siliceous Iron	3 1 0	3 1 0
No. 3 G.M.B.	2 18 6	2 18 6
No. 4 Foundry	2 17 6	2 17 6
No. 4 Forge	2 17 0	2 17 0
Mottled	2 16 6	2 16 6
White	2 16 6	2 16 6
MIDLANDS—		
(c) Staffs.—	(*Delivered to Station*).	
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 1 0	—
„ „ Foundry	3 6 0	—
(c) Northampton—		
Foundry No. 3	3 2 6	—
Forge	2 17 6	—
(c) Derbyshire—		
No. 3 Foundry	3 6 0	—
Forge	3 1 0	—
(3) Lincolnshire—		
No. 3 Foundry	—	—
No. 4 Forge	—	—
Basic	—	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	3 15 6 (*a*)	—
	4 0 6 (*b*)	—
	4 5 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	9 15 0	9 5 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 5 0	—
Common Bars	9 5 0	—
Best Bars	10 5 0	—
Double Best Bars	10 15 0	—
Treble Best Bars	11 5 0	—
LANCS.—		
Crown Bars	9 15 0	—
Best Bars	10 5 0	—
Hoops	12 0 0	—
S. YORKS.—		
Crown Bars	9 15 0	—
Best Bars	10 15 0	—
Hoops	12 0 0	—
MIDLANDS—		
Crown Bars	9 0 0 to 9 15 0	—
Marked Bars (Staffs.)	12 0 0	—
Nut and Bolt Bars	8 0 0 to 8 10 0	—
Gas Tube Strip	10 10 0	—

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates (Marine)	9 0 0	8 10 0
„ „ (Land)	—	—
Ship Plates, ½in. and up	8 15 0	7 15 0
Sections	8 7 6	7 7 6
Steel Sheets, ¼in.	7 15 0	7 15 0
Sheets (Gal. Cor. 24 B.G.)	11 0 0	9 10 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 15 0	7 15 0
Angles	8 7 6	7 7 6
Boiler Plates (Marine)	10 10 0	—
„ „ (Land)	10 0 0	—
Joists	8 15 0	7 7 6
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	7 2 6	—
Soft Billets	5 10 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 5 0	—
Light Rails	8 10 0 to 8 15 0	—
Billets	6 10 0 to 9 0 0	—
MANCHESTER—		
Bars (Round)	9 7 6	—
„ (Small Round)	6 15 0 to 7 0 0	—
Hoops (Baling)	10 0 0	9 15 0
„ (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
„ (Lancs. Boiler)	8 10 0 to 8 12 6	—
SHEFFIELD—		
Siemens Acid Billets	9 2 6 (basis)	—
Hard Basic	8 2 6 and 8 12 6	—
Intermediate Basic	6 12 6 and 7 2 6	—
Soft Basic	5 15 0	—
Hoops	9 10 0 to 9 15 0	—
Soft Wire Rods	7 10 0	—
MIDLANDS—		
Small Rolled Bars (all British)	7 0 0 to 7 5 0	—
Small Re-rolled Bars	6 7 6 to 6 10 0	—
Billets and Sheet Bars	4 17 6 to 5 7 6	—
Galv. Sheets, f.o.b. L'pool	9 2 6 to 9 7 6	—
(2) Staffordshire Hoops	9 10 0	—
(*d*) Angles	8 7 6	—
(*d*) Joists	8 15 0	—
(*d*) Tees	9 7 6	—
(*d*) Bridge and Tank Plates	8 17 6	—
Boiler Plates	8 7 6 to 8 10 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14 f.o.b.	15/0 to 15/6
Block Tin (cash)	157 5 0
„ (three months)	158 15 0
Copper (cash)	37 17 6
„ (three months)	38 0 0
Spanish Lead (cash)	14 0 0
„ „ (three months)	14 7 6
Spelter (cash)	16 5 0
„ (three months)	16 10 0
MANCHESTER—	
Copper, Best Selected Ingots	41 0 0
„ Electrolytic	40 10 0
„ Strong Sheets	68 0 0
„ Tubes (Basis Price), lb.	0 0 10½
Brass Tubes (Basis Price), lb.	0 0 9¼
„ Condenser, lb.	0 0 11½
Lead, English	16 5 0
„ Foreign	14 10 0
Spelter	16 7 6
Aluminium (per ton—raw ingot)	£95

FERRO ALLOYS.

	Per Ton. £ s. d.	Per Unit.
Tungsten Metal Powder	2/– per lb.	
Ferro Tungsten	1/9 per lb.	
Ferro Chrome, 4 p.c to 6 p.c. carbon	£25 0 0	8/–
„ „ 6 p.c. to 8 p.c.	£24 10 0	7/6
„ „ 8 p.c. to 10 p.c.	£23 5 0	7/–
„ „ Specially Refined		
„ „ Max. 2 p.c. carbon	£37 0 0	11/–
„ „ „ 1 p.c. carbon	£44 10 0	14/–
„ „ „ 0·70 p.c. carbon	£46 0 0	16/–
„ „ „ carbon free	1/1 per lb.	
Metallic Chromium	2/9 per lb.	
Ferro Manganese (per ton)	£10 15 0 for home	
„ „ „	£9 15 0 for export	
„ Silicon, 45 p.c. to 50 p.c.	£13 10 0 scale 5/– per unit	
„ „ 75 p.c.	£19 0 0 scale 6/– per unit	
„ Vanadium	12/6 per lb.	
„ Molybdenum	6/3 per lb.	
„ Titanium (carbon free)	9d. per lb.	
Nickel (per ton)	£245 0 0	
Ferro Cobalt	7/9 per lb.	

FUELS.

SCOTLAND.

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	13/–
„ „ Ell	14/–
„ „ Splint	13/9 to 14/9
„ „ Trebles	13/– to 13/6
„ „ Doubles	11/6
„ „ Singles	10/–
AYRSHIRE—	
(f.o.b. Ports)—Steam	11/6
„ „ Jewel	16/6
„ „ Trebles	13/6
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	10/3 to 12/6
Screened Navigation	16/6
Trebles	14/6 to 15/6
Doubles	12/–
Singles	10/–
LOTHIANS—	
(f.o.b. Leith)—Best Steam	11/– to 11/6
Secondary Steam	10/6
Trebles	14/–
Doubles	11/6
Singles	9/9 to 10/–

(8) N.W. COAST— ENGLAND.

	Export.
Steams	21/–
Household	32/6 to 51/8
Coke	19/– to 22/6
NORTHUMBERLAND—	
Best Steams	13/6
Second Steams	12/3 to 12/6
Steam Smalls	8/6
Unscreened	12/6 to 13/–
Household	27/– to 39/–
DURHAM—	
Best Gas	14/6
Second	13/3 to 13/6
Household	25/– to 37/–
Foundry Coke	24/–

SHEFFIELD—	Inland.
Best Hand-picked Branch	27/– to 28/– —
South Yorkshire Best	22/– to 24/– —
Derbyshire Best House	22/– to 23/6 —
Derbyshire Best Brights	18/– to 20/– —
Screened House Coal	17/– to 18/6 —
Kitchen Coal	16/– to 17/6 —
Best Screened Nuts	16/– to 17/6 —
Small Screened Nuts	15/– to 16/6 —
Yorkshire Hards	17/– to 18/– —
Derbyshire Hards	17/– to 18/– —
Rough Slacks	8/6 to 9/6 —
Nutty Slacks	7/– to 8/6 —
Blast-furnace Coke (Inland)	9/6 to 9/9 on rail at ovens
Furnace and Foundry Coke (Export), f.o.b., 14/6 to 15/6	

(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	19/6 to 19/9
Second Smokeless Large	18/9 to 19/6
Best Dry Large	19/– to 19/6
Ordinary Dry Large	17/9 to 18/3
Best Black Vein Large	18/3 to 18/6
Western Valley Large	17/9 to 18/–
Best Eastern Valley Large	17/7½ to 17/9
Ordinary Eastern Valley Large	17/3 to 17/6
Best Steam Smalls	13/– to 13/6
Ordinary Smalls	11/– to 13/–
Washed Nuts	19/– to 25/–
No. 3 Rhondda Large	19/6 to 19/9
„ „ Smalls	15/– to 16/–
No. 2 „ Large	17/– to 17/3
„ „ Through	15/6 to 16/–
„ „ Smalls	14/– to 14/3
Foundry Coke (Export)	22/6 to 36/6
Furnace Coke (Export)	17/– to 18/–
Patent Fuel	20/–
Pitwood (ex ship)	19/6 to 20/6
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	36/– to 38/6
Seconds	27/– to 32/6
Red Vein	22/6 to 27/6
Machine-made Cobbles	41/6 to 48/6
Nuts	40/– to 48/6
Beans	28/6 to 32/6
Peas	19/6 to 21/–
Breaker Duff	8/6 to 9/6
Rubbly Culm	11/– to 11/9
Steam Coals:	
Large	20/– to 20/6
Seconds	18/– to 20/–
Smalls	11/6 to 13/–
Cargo Through	16/– to 17/6

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate: Joists (minimum), 22/6: Ordinary Ship, Bridge, and Tank Plates and Sections, 15/– if home consumers confine purchases from associated British Steel Makers. (*e*) Delivered Black Country Stations.

French Engineering Notes.

(From our own Correspondent in Paris.)

Paris Transports.

THE centralising of all the transport arrangements in the Department of the Seine in the hands of the Conseil Général of the Seine and the Paris Municipal Council has had the effect of extending considerably the traffic facilities, which are now reaching out to towns nearly 50 miles beyond the city. Being a municipal and departmental monopoly, the transport services are not competitive, and the idea is to merge them in the public interest as well as in the interest of municipal and departmental finances. The attempt to bring the surface systems under the indirect control of the Metropolitan Railway Company has not yet succeeded, nor does it seem likely to be realised, and there is every prospect now of the Société des Transports en Commun being granted a renewal of its concession under new conditions. The tramways within the city are being suppressed. Since 1925 about fifty lines have been removed and replaced with omnibuses, and the remainder will disappear when the Société des Transports en Commun takes delivery of the omnibuses which are now on order. The Metropolitan Railway Company is taking over suburban lines of the Paris-Orleans Company. One of the leading motor car firms has now secured permission to organise omnibus services radiating from the Place de la Concorde to outer suburban towns. There will be ten radial lines to such towns as Fontainebleau, Coulommiers, Meaux, Creil, and Mantes.

Coal.

The statement recently published to the effect that Polish delegates who had come to this country to negotiate for commercial advantages had returned to Poland with an agreement whereby the monthly quota of coal imported would be increased from 40,000 to 100,000 tons as a set-off against privileges accorded to certain French products by Poland, has not been denied officially, but prominence is given to a statement of the South Wales Exporters' Association that it has received an official assurance that no such measure has been taken by the French authorities. It is difficult to see how the French Government could give advantages of this kind to one country at the expense of other countries without incurring the charge of discrimination, which the French have obviously every reason to avoid. The question of carrying coal in French colliers was also raised by Monsieur Meyer, Minister of the Mercantile Marine, who visited last week the harbour extensions and new harbour station at Cherbourg, when he referred to the fact that 250,000 tons of colliers are laid up, and he declared his intention of making import licences conditional on 50 per cent. of the coal being carried in French ships. He knew, he said, that British freights were lower than the French, but as the price of coal had declined it was only right that importers should sacrifice some of this advantage in order to provide work for French ships. As the freights for coal arriving from the Baltic are extremely low, the compulsory carrying on French bottoms of one-half of the fuel imported may increase the cost unduly to the consumer, and this would certainly tend to put as much of the sacrifice as possible on British shipping.

Colonial Oils.

The colonial oil industry has been receiving particular attention on account of its importance as an economic factor, because the potential supplies of vegetable oils from French West Africa are capable of meeting all home requirements on condition that producers are able to make the industry pay and that means can be found of using such oils for industrial purposes. There are difficulties in the way of creating a prosperous industry, and the French Colonial Institute has formed a central committee to deal with all technical and commercial questions in the hope of reaching a satisfactory solution. Senegal is suffering from an over production of ground nuts and a collapse of prices on the international market. Ground nut oil has nearly ruined the olive oil industry in North Africa and the South of France. A remedy for this state of things has been sought in the utilisation of vegetable oils as a fuel for internal combustion engines, and early in the year a small caravan of motor lorries set out for Africa with the idea of running them on locally produced vegetable oils. The journey across the Sahara Desert ended in disaster, and Monsieur Charles Roux, who was in charge of the caravan, continued his experiments without the aid of the lorries which had broken down on the desert sands. It is reported that one result of his researches is that boats navigating on the Niger are running satisfactorily with a mixture of vegetable oils. It is, of course, recognised that vegetable oils can be used for some engines besides those of the solid injection type, but even with these the results are only satisfactory when the engines are adapted to run on particular oils, while furthermore it has not yet been found possible to reduce the margin of cost between vegetable and mineral oils.

Iron and Steel Production.

The monthly figures of iron and steel production issued by the Comité des Forges show that in July the output of pig iron totalled 453,000 tons, as compared with 679,000 tons in the corresponding month of 1931 and of 864,000 tons in July, 1929. There were eighty-one furnaces in blast, as compared with 115 in July of last year. The production of raw steel amounted to 465,000 tons, as compared with 651,000 tons in the similar month of last year and 808,000 tons in July, 1929. In finished iron and steel products, rails, sleepers and accessories amounted in July last to 21,111 tons, as against 34,000 tons a year ago; joists, 54,000 tons, as compared with 67,000 tons; rods, 20,000 tons, as against 24,000 tons; strips, 15,000 tons, as against 17,000 tons; merchant bars, 104,000 tons, as compared with 175,000 tons; thin sheets, 46,000 tons, as against 53,000 tons; and thick sheets, 17,000 tons, as compared with 27,000 tons. It will be observed that the heavy decline of rolled products does not account for the much heavier fall of raw iron and steel, which can only be attributed to a declension of exports of pig iron, blooms, and billets.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

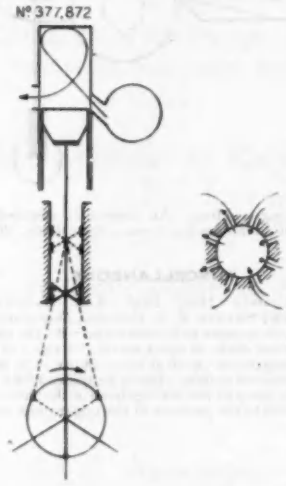
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

INTERNAL COMBUSTION ENGINES.

377,872. November 26th, 1931.—MULTI-CYLINDER TWO-STROKE ENGINES, Allgemeine Elektricitäts-Gesellschaft, Friedrich Karl-Ufer 2/4, Berlin, N.W.40, Germany.

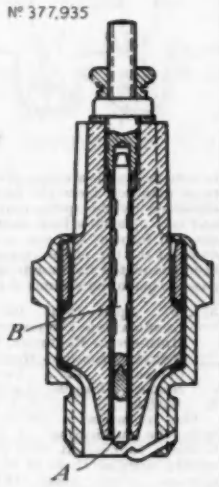
The inventors explain that with a multi-cylinder two-stroke engine scavenged by means of a single reciprocating pump

Nº 377,872.



there is a liability for the cylinders to get unequal shares of the scavenging air on account of the relative angular positions of the several cranks. As a consequence, they graduate the cross-sectional area of the scavenging ports so that the supply to those cylinders liable to take too large a share is throttled.—*August 4th*, 1932.

Nº 377,935



377,935. June 14th, 1932.—SPARKING PLUGS, Siemens and Halske Aktiengesellschaft, Berlin-Siemensstadt, Germany.

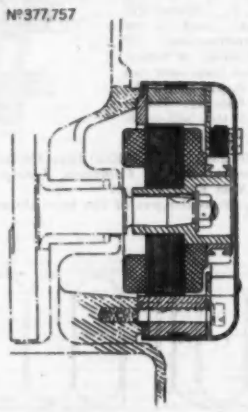
This specification starts with a long explanation of the difficulties experienced with the sparking plugs of engines that run hot. These difficulties, it is claimed, are overcome in the plug illustrated. It has a tungsten electrode A, which is fused into a copper conductor B. The tungsten is degassed and the copper smelted in a vacuum. The fusion is also effected in a vacuum. It is said that the coefficient of expansion of the tungsten is practically identical with that of the highly calcined aluminium-oxide of the insulator.—*August 4th*, 1932.

DYNAMOS AND MOTORS.

377,757. May 4th, 1931.—DYNAMO-ELECTRIC MACHINES, The British Thomson-Houston Company, Ltd., Crown House, Aldwych, London, W.C.2, and Leonard Griffiths, of "Kennington," Biggin Hall-crescent, Coventry.

The dynamo described in this specification is particularly suitable for providing current for lighting on self-propelled

Nº 377,757.



vehicles, such as motor cycles. The object of this invention is to provide an inexpensive generator for this purpose. The generator is formed in three main units, which can be readily assembled. One unit is mounted directly on the end of the engine crank shaft, and consists of the armature and commutator; a second unit, which is spigoted on the engine case concentric with the armature, consists of the field magnets, polepieces and brushgear, the third unit being a metal cover which encloses the other two units as shown.—*August 4th*, 1932.

SWITCHGEAR.

377,750. May 4th, 1931.—ELECTRIC SWITCHGEAR, A. Reyrolle and Co., Ltd., of Hebburn-on-Tyne, Durham; Henry William Clothier, of Murcott, 3, Jesmond Park West, Newcastle-on-Tyne, and Edgar Waterhouse, of Briardene, Cleadon, near Sunderland.

The object of this invention is to improve switchgear by reducing weight and space while maintaining ample spaces between the contacts and tank. The tank A is substantially cylindrical with slightly convex ends B. It has a flanged opening at its top, where it is secured by bolts and nuts to the plate D of the circuit breaker. Conductors C carry the fixed contacts E of the phase switches which co-operate with movable contacts

Nº 377,750.

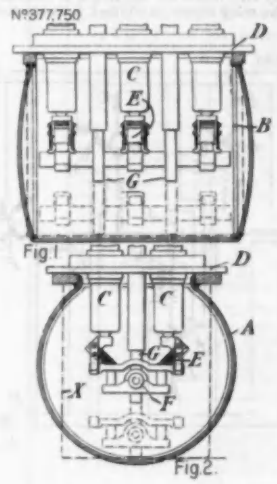


Fig. 1.

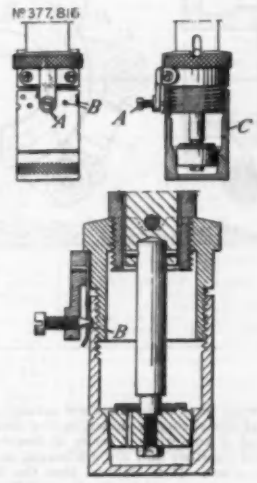
Fig. 2.

carried on the bar F and are raised and lowered by the operating rods G. When the switch contacts are closed they lie approximately on a diameter of the tank A, which gives a large radial depth of oil between the contacts and the inner wall of the tank. The chain line X indicates the inside wall of the rectangular tank usually fitted to switchgear of this description, and a reference to Fig. 2 will show the very considerable increased distance between the contacts in their closed position and the inside wall of the tank, which is obtained by the employment of a cylindrical tank with its axis horizontal and the contacts disposed approximately on a diameter. In each of the figures the position of the movable contacts when the switches are fully open is indicated in chain lines.—*August 4th*, 1932.

377,816. July 31st, 1931.—TIME LAG DEVICES FOR USE WITH ELECTRIC SWITCHES, Albert Browne Mudie, of 51, Billesley-lane, Moseley, Birmingham.

This invention relates to time lag devices for use with electric switches and refers more particularly to that type of device which includes a cup for oil or other fluid and a disc adapted to engage a suitable surface in the cup with a sucker-like action, the disc being adjustable towards or away from the surface so that the degree of adhesion can be varied as desired. The sleeve or cap is provided with an external lug carrying the locking screw and the exterior of the cup is provided with a series of spaced holes or recesses B for engagement by the screw. In order to ensure that the holes or recesses will be conveniently spaced, a double or multiple or rather quick-pitched thread is provided on the screw part of the sleeve or cap and cup. Another feature is the provision of a sleeve or cap with an external shoulder which engages the top of the cup when the disc is in its position of greatest adhesion, so that when subsequent adjustments are made, the gap between the external shoulder and the top of the cup forms an automatic indicator enabling the operator to see at a glance to what extent the disc has been

Nº 377,816.

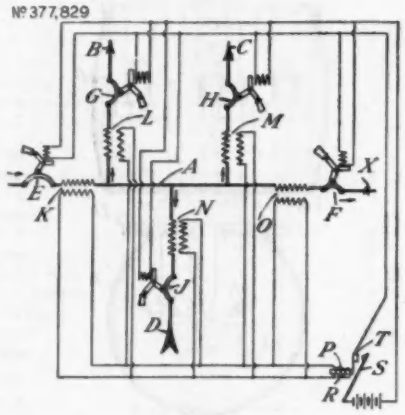


raised off the surface with which it is to co-operate. The provision of this external shoulder on the sleeve or cap which engages with the top of the cup serves to limit the degree of adhesion which can be obtained between the disc and the surface with which it co-operates, and avoids the possibility of obtaining a very high degree of adhesion such as would result in a dangerously large time lag. A plate or wire spring is provided on the inner side of the lug, and has a projection adapted automatically to spring into engagement with the holes or recesses provided for engagement by the screw. This arrangement provides an automatic stop or click device so that the operator can easily tell when the screw is opposite to one of the holes or recesses. With this arrangement the point of the screw may engage directly behind the projection on the spring so as to lock it into engagement with the hole or recess. In operation adjustment is a very simple matter, as it is only necessary to unscrew the screw A slightly, when the cup C may be turned by hand into the desired position, the spring clicking into the

recesses one after another until the desired recess has been reached. The screw A can then be re-tightened.—*August 4th*, 1932.

377,829. September 3rd, 1931.—PROTECTION OF D.C. NETWORKS, Union d'Electricité, of 3, rue de Messine, Paris, France.

This specification describes an instantaneous selective protective arrangement for D.C. networks, against short circuits which may arise either directly between the conductors or between the conductors and earth. A represents a continuous current conductor with branches B, C and D. At each end of the conductor A serving for its protection against short circuits and at the beginning of each of the branches, circuit breakers E, F, G, H and J are placed. At each of the extremities of the conductor A, and in each branch, there are also current transformers K, L, M, N, O, the primary circuits of which are each connected in series with the corresponding continuous current conductor. The secondary windings of these current transformers are all connected in parallel and feed the winding P of a single relay R. When the winding P is excited the movable contact S of the relay comes in contact with the fixed contact T

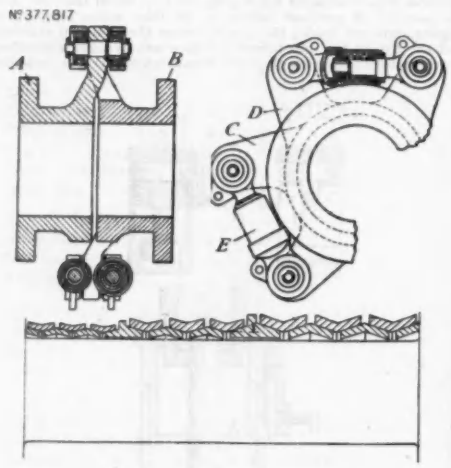


of this relay, which causes the simultaneous excitation of release coils of the circuit breakers E, F, G, H and J. When a short circuit is produced in the continuous current network, but outside the protected zone limited by the circuit breakers (at X, for example), the continuous current varies more or less sharply, and this variation induces electromotive forces in the secondaries of the current transformers. But as the short circuit has taken place outside the zone limited by the current transformers, the sum of the currents which enter and which leave this section—for example, in the sense of the arrows—is zero, and the relay R is not excited. If, on the other hand, a short circuit is produced in the conductor A within the protected zone, the sum of the currents entering and leaving this zone is no longer zero. The transitory period during which the short circuit is established thus induces at the terminals of the secondaries of the current transformers electromotive forces which cause the excitation of the relay R, and as a result the simultaneous opening of the circuit breakers guarding the section.—*August 4th*, 1932.

TRANSMISSION OF POWER.

377,817. July 31st, 1931.—SPRING COUPLINGS, Aktiengesellschaft Brown Boveri et Cie., Baden, Switzerland.

This coupling is intended to prevent the resonance of a driven shaft and its engine, at critical speeds, in such cases as ships' propelling machinery. The engine crank shaft and the propeller shaft are connected together by flanges A and B, having arms

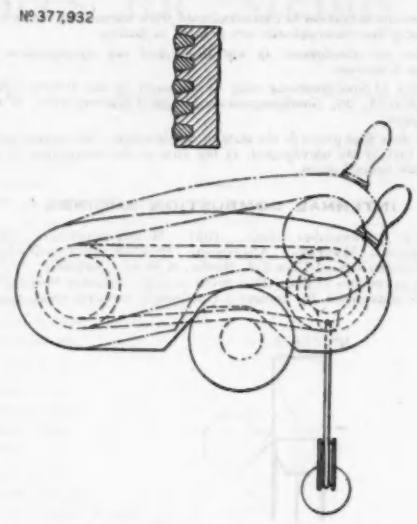


C and D. Between these arms there are arranged spring boxes E. The form of the spring is shown in the detail sketch. It will be seen that it comprises a series of doubly coned rings, which are nested together and are graduated in stiffness from one end to the other. It is claimed that the damping effect of this spring is proportional to the force it has to oppose.—*August 4th*, 1932.

MACHINE TOOLS AND SHOP APPLIANCES.

377,932. April 27th, 1932.—WINDING WIRE ON SPOOLS, Sir James Farmer Norton and Co., Ltd., Adelphi Ironworks, Salford, Manchester.

In winding fine wire on a spool it is common practice to drive the spool by means of a belt which bears on the wire itself and consequently gives a constant linear speed regardless of the diameter of the spool. The arrangement is, however, liable to cause the breakage of the wire. The inventors consequently use a series of V-shaped belts, as shown in the cross section. Each belt may be upon a separate pulley and all the pulleys on the driving shaft be frictionally driven to allow of a limited amount of slip in case of excessive wire tension during winding. A certain amount of slip is sometimes found advantageous between the belts and the wire upon the spool, and this may be allowed for by suitably shaping the back or operative face of each belt to reduce the surface in contact with the wire upon

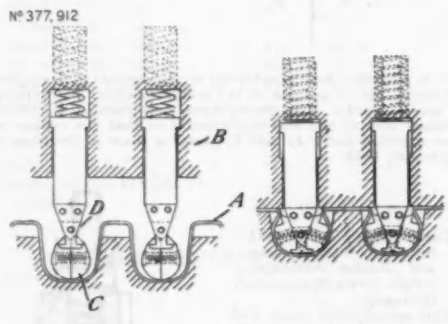


the spool during winding. An arched or rounded back belt as shown is an advantageous form.—*August 4th*, 1932.

MISCELLANEOUS.

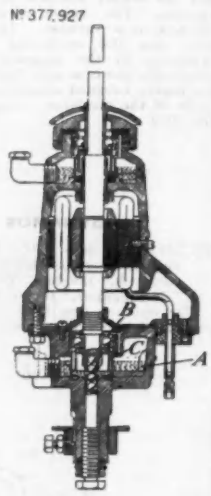
377,912. February 24th, 1932.—THE MANUFACTURE OF CORRUGATED SHEETS, E. E. Eriksson, Degerfors, Sweden.

This invention appears to be concerned with the production of radiator elements made of sheet metal. A sheet of metal with pre-formed corrugations, such as those shown at A, is placed in a press with a grooved platen. It will be noticed that the grooves are not quite so deep as the corrugations of the sheet. The sheet is then subjected to the pressure of the upper press ram B, which



is furnished with a series of collapsible "mandrels" C. When these mandrels meet the bottom of the corrugations they are expanded by the spring-borne pressure of the wedge piece D and take up such a form that they give a definite shape to the dovetail form of the new corrugation caused by the crushing down of the top of the corrugations. When the operation has been completed the mandrels collapse, on being withdrawn, to pass the narrowed summit of the corrugation.—*August 4th*, 1932.

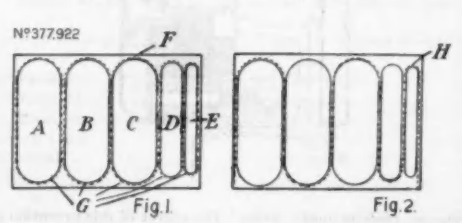
377,927. April 12th, 1932.—LUBRICATING DEVICES FOR HIGH-SPEED BEARINGS, *The British Thomson - Houston Company, Ltd., Crown House, Aldwych, London, W.C.2.*



This invention is concerned with the lubrication of ball bearings running at very high speeds, such as those of rayon spinners, which make 12,000 revolutions per minute, or even more. It is remarked that should such a bearing be supplied with too much lubricant abnormal friction results. The inventors aim at the provision of only just sufficient oil for lubricating purposes, and this appears to be delivered from the well A to the bearing B by the sleeve C, which is variously described as a "cylindrical feeding element" and as of "a tapered construction." If it is really of conical or rather truncated conical form one can appreciate that it will throw the oil up into the bearing. But if it is cylindrical the action is obscure.—*August 4th*, 1932.

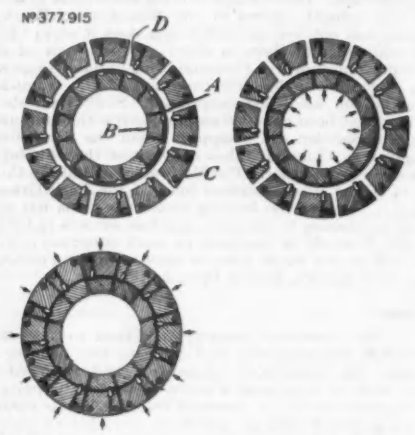
377,922. March 23rd, 1932.—ELECTRIC CONDENSERS, *International General Electric Company, Incorporated, of 120, Broadway, New York, U.S.A.*

The screening of condensers of the type shown has hitherto been effected by means of added metal partitions disposed in the casing between the condenser elements, but this renders the manufacture of the condensers more costly. The added partitions in the casing of the condenser described are eliminated and the various condenser elements are surrounded and screened by metal foil. In Fig. 1 the condenser coils A B C D and E are disposed in a casing F and are surrounded by metal foil G. The foil of each condenser coil is in contact with the foil of the next, while the foil of the coiled element E is in contact with the casing for the condenser, which is preferably made of metal. Each coiled element is entirely wrapped in metal foil, whereas in the example of Fig. 2 all the elements are screened by one common screening layer H constituted by a foil strip sinuously disposed between the adjacently lying coiled elements.—*August 4th*, 1932.



377,915. March 1st, 1932.—INDENTING METALLIC ELEMENTS, The Budd Wheel Company, 2500, Hunting Park-avenue, Philadelphia, Pennsylvania.

This is a short description of what must be a highly complicated machine for forming the rim of a motor car wheel. The blank rim is shown at A and is dropped over a group of



expandible dies B. In this way it is stretched, formed to some extent and held firmly by the dies. The outer set of dies C is then contracted and the tools D form indentations, presumably for the attachment of the spokes. The inventors appear to be insistent on the simultaneous operation of all the dies, as if the process is made step by step the tire is liable to be distorted.—*August 4th*, 1932.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Tuesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY TO MONDAY, SEPTEMBER 19TH.

INSTITUTION OF MECHANICAL ENGINEERS.—Summer visit to Canada.

SATURDAY, SEPTEMBER 10TH.

BELFAST ASSOCIATION OF ENGINEERS.—Visit to the Baun Drainage Scheme and trip to Portrush. Leave City Hall, Belfast, 1.15 p.m.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Eastern District meeting to be held at Great Yarmouth. Assemble at Town Hall, Great Yarmouth, 10.30 a.m.

MONDAY, SEPTEMBER 12TH.

INSTITUTE OF METALS.—At the Institution of Mechanical Engineers, Storey's-gate, Westminster, S.W. 1. Annual autumn lecture, "Corrosion Fatigue in Metals," by Dr. H. J. Gough. 8 p.m.

MONDAY TO THURSDAY, SEPTEMBER 12TH TO 15TH.

IRON AND STEEL INSTITUTE AND INSTITUTE OF METALS.—Joint autumn meeting in London. For programme see page 119.

TUESDAY, SEPTEMBER 13TH.

INSTITUTE OF MARINE ENGINEERS.—85, The Minories, E.C.3. Presidential Address. Commander C. W. Craven, R.N. (retd.). 6 p.m.

TUESDAY TO SATURDAY, SEPTEMBER 13TH TO 17TH.

INTERNATIONAL FOUNDRY CONGRESS.—Paris.

SATURDAY, SEPTEMBER 17TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—North-Eastern District meeting. Visit to Roman Wall, Northumberland. Assemble at George Inn, Chollerford. 11 a.m.

THURSDAY, SEPTEMBER 22ND.

OPTICAL SOCIETY.—At the Imperial College of Science and Technology, Imperial Institute-road, South Kensington, S.W.7. Special general meeting. 5.30 p.m.

SATURDAY, SEPTEMBER 24TH.

ALL-BRITISH EXHIBITION.—Copenhagen, Denmark, Opening.

WEDNESDAY, SEPTEMBER 28TH.

BELFAST ASSOCIATION OF ENGINEERS.—Belfast. Inspection of new laundry, Poor Law Union. 7.30 p.m.

INSTITUTION OF WELDING ENGINEERS: NORTH-WESTERN BRANCH.—College of Technology, Sackville-street, Manchester. "Testing of Welds," by Mr. L. W. Schuster. 7.30 p.m.

FRIDAY, OCTOBER 7TH.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, S.W.1. "Cornwall as a Cradle of Science and Engineering," by Mr. S. J. Crispin. 7.30 p.m.

FRIDAY, OCTOBER 14TH.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, S.W.1. Chairman's Address, Mr. J. Foster Petrie. 7.30 p.m.